

# Compressed Air

*Magazine*

SEPTEMBER 1956



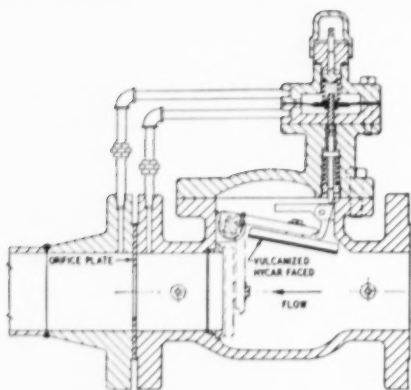
•  
**RETRIEVER FOR  
LANDING CRAFT**

Machine can pick up and  
carry 67-ton vessel in  
or out of the water

(SEE INDEX PAGE)

VOLUME 61 • NUMBER 9

NEW YORK • LONDON

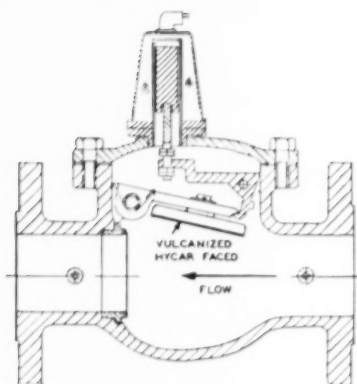


Model 1200, "Sentry" excess flow valve automatically and instantaneously shuts off when the rate of flow in the line exceeds a predetermined rate.

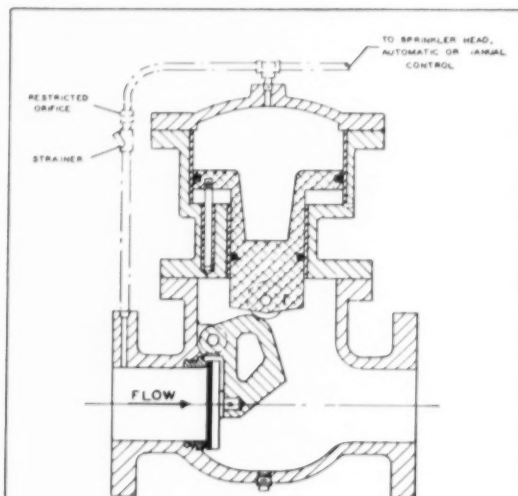
"Sentry" valves are full flow valves, for use on liquid and gas lines . . . protect property, materials and processing. Model 1200 illustrated.



Other types "Sentry" Valves: high-pressure and low-pressure and over temperature shut-off valves available.



Models 1700 and 1800 "Sentry" solenoid shut-off valves operate by remote electrical control automatically and instantaneously. In Model 1700, solenoid is energized, in Model 1800 solenoid is de-energized to maintain flow.



Model 3000 "Sentry" piston operated quick-opening valve opens instantaneously when the pressure above piston is released. Ideal for deluge systems — and for remote opening and closing of fuel line.

## Now Coppus brings you "Sentry"® Valves for automatic protection

These valves are *patented* quick-closing latch type and quick-opening piston type. All are full flow valves.

Latch-type "Sentry" valves are widely used in the chemical, petroleum and gas industries for closing automatically and instantaneously gas, process and fuel lines. The piston type valve can be automatically or manually opened and closed

from any remote location. It is ideal for deluge systems, operates instantly; closing of this valve is against the flow, eliminating water hammer.

Sizes run from 1½" to a full 8". For full information send for Coppus Bulletin 500 to Coppus Engineering Corporation, 229 Park Avenue, Worcester 2, Massachusetts.



LOOK FOR THE BLUE BAND THAT IDENTIFIES COPPUS QUALITY



# KEEP IT CLEAN...

by Phil Tration



To say that *every* pipe line needs a Dollinger filter is certainly an exaggeration. However, nearly all air-operated tools, instruments, controls, and industrial processes, must be protected from destructive dirt, dust, pipe scale, and condensates... and nothing does this job better than a Dollinger Pipe Line Filter.

*Model CPH Pipe Line Filter*, illustrated at the right, has the exclusive "double action principle". Air is first deflected to outer walls of Filters and forced downward at high speed. Water, oil, and heavier particles of rust, etc. are thus deposited in base. Mechanically cleaned air then rises to pass through filter-

MODEL CPH  
PIPE LINE FILTER



ing medium which removes lighter air-borne particles. This "double action" design eliminates need for frequent cleaning.

Inexpensive, simple to install, Dollinger Pipe Line Filters pay for themselves in reduced maintenance alone. Why not talk over your filtration problems with a Dollinger engineer... or write for bulletin 200 which gives engineering data on pipe line filters. Dollinger Corporation, 7 Centre Park, Rochester 3, New York.

## DOLLINGER STAYNEW FILTERS

LIQUID FILTERS • PIPE LINE FILTERS • INTAKE FILTERS • HYDRAULIC FILTERS  
ELECTROSTATIC FILTERS • DRY PANEL FILTERS • SPECIAL DESIGN FILTERS  
VISCOSUS PANEL FILTERS • LOW PRESSURE FILTERS • HIGH PRESSURE FILTERS  
AUTOMATIC VENTILATION FILTERS • NATURAL GAS FILTERS • SILENCER FILTERS

**"I got 5 years of service from a valve I expected to last only 90 days"**

Mr. C. L. Worthington, Chief Engineer for E. L. Bruce Co., Little Rock, Arkansas plant, standing near a Walworth No. 225P Bronze Globe Valve with "500 Brinell" stainless steel seats and discs that was installed in severe boiler blowdown service. Hardened seats and discs are especially resistant to wire drawing, steam cutting, or galling.



Some time ago Mr. C. L. Worthington, Chief Engineer for E. L. Bruce Co. plant at Little Rock, Arkansas, was having valve trouble on some newly installed boilers. The first boiler to go in service generated 600 hp operating at 200-pounds pressure. The water was so bad that a hot lime and soda ash water softener treatment had to be used, and it was necessary to add other chemicals to this solution from time to time. Mr. Worthington wanted to use a continuous blowdown to skim off the worst part of the scum on the water. He installed a small blow pipe about an inch below the normal water level in the boiler. This worked well, except that the one-inch valve on the line

could only be partially opened and let a small part of the scum be blown off at one time. If the valve was widely opened, it would not take long to lower the water level in the boiler and run the steam pressure down. This service gave Mr. Worthington lots of valve trouble, as can well be imagined, because of the extreme wire drawing that occurred.

One day the Walworth representatives in that area, called upon Mr. Worthington and demonstrated the outstanding features of the Walworth No. 225P Bronze Globe Valve. This valve, which has a working steam pressure rating of 350-pounds at 550°F, has a plug-type stainless steel seat and disc which has been heat treated to a minimum hardness of 500 Brinell. After listening to the Walworth men and examining a 225P valve, Mr. Worthington agreed that he would try one in the severe service described. He said if it lasted 90 days, he would consider that it had done a good job.

The valve went into service and came out within three days of being in service five years under very severe operating conditions. The valve was used 24 hours a day from early in the morning on Monday until Saturday night, when it was closed until the following Monday morning. It was never opened more than three-quarters of a turn, and

most of the time it was opened only one-half to one-quarter of a turn. For the life of the valve, nearly five years, it never failed to give a 100% closure when shut on Saturday night until opened Monday morning.

When another 600 hp 200-pound pressure boiler went into service, it also was equipped with a one-inch Walworth No. 225P Bronze Globe Valve on the same service.

In view of the severe service and the wire drawing to which this valve was subjected, it is interesting to note that the original valve (which was taken out of service almost five years after it had been installed) was removed — not because the seat and disc were wire drawn — but because the turbulence of the steam had finally caused a small hole to occur in the wall of the body of the valve. Needless to say, the valve that was taken out of service was replaced immediately by another one-inch Walworth No. 225P Bronze Globe Valve, positive assurance that Mr. Worthington is satisfied that this valve has "done a good job."






Other Walworth products include complete lines of Gate, Globe, Angle, Check and Lubricated Plug Valves in bronze, iron, steel, stainless steel and special alloys. Complete information and literature will be furnished upon request.



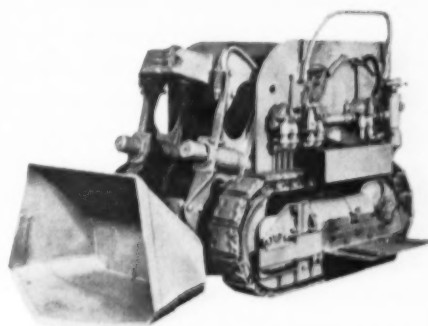
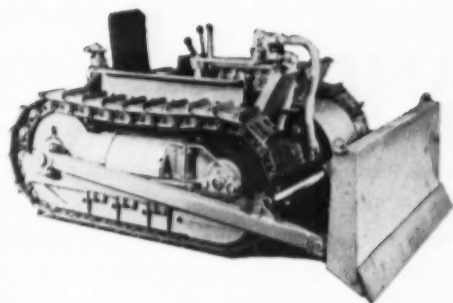
A Walworth No. 225P Bronze Globe Valve that gave perfect performance for four years and 362 days in a severe boiler blowdown service where the Chief Engineer said he had never been able to keep a valve more than 60 to 90 days.

# WALWORTH

60 East 42nd Street, New York 17, New York

SUBSIDIARIES:  DLOYD ALLOY STEEL PRODUCTS CO.  CONOFLOW CORPORATION  M & H VALVE & FITTINGS CO.  
 SOUTHWEST FABRICATING & WELDING CO., INC.  WALWORTH COMPANY OF CANADA, LTD.

**NOW! IN CRAWLER TYPE MACHINES  
FOR TRACKLESS WORK, THE SAME  
HEAVY RUGGED CONSTRUCTION AND  
DEPENDABILITY THAT THE INDUSTRY  
HAS HAD IN EIMCO WHEEL TYPE  
MACHINES.**



Fast, sharp maneuvers, regulated by fingertip control make the EIMCO 630 EXCAVATOR a production giant and an operator's delight.

With the power at his fingertips to move one track into forward motion while the other is in reverse motion, an operator can make the 630 veritably "walk" around a muck pile—working from any angle without backing to make a new approach.

Eimco 630 agility permits operators to quickly master movement of the machine to a point that lost motion is eliminated between excavating and discharge stages.

While the 630 is moving between points of excavation and dumping, the bucket progressively elevates in an arc. Through proper timing, arrival of the 630 and bucket discharge become simultaneous operations. And the large half-yard bucket provides greater tonnage at every discharge.

These three pluses—extra maneuverability, operational ease and larger bucket capacity added in terms of economic value to you mean **MORE TONNAGE IN LESS TIME.**



B-215

## **THE EIMCO CORPORATION**

Salt Lake City, Utah—U.S.A.

• Export Offices: Eimco Bldg., 52 South St., New York City

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# MODERN OIL AND GAS FIRED BOILERS

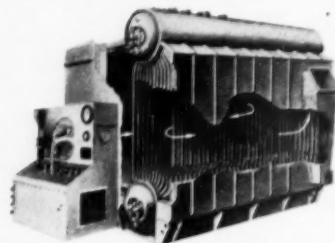
The boilers illustrated here cover the broad capacity range from 4,000 to 600,000 lb of steam per hr. They are all especially designed for gas and/or oil firing. The two units illustrated at right (Types VP and VU-55) are standardized and each is available in several sizes. The capacity range covered by these two units is from 4,000 to 120,000 lb per hr. The two units below are custom designed for various capacity, pressure and temperature requirements up to 600,000 lb per hr, 1400 psi and 950 F. All these units are pressure fired and do not require induced draft fans.

Collectively, they offer an exceptional diversity of choice. A brief consideration of the features of each type will help you "pinpoint" the design characteristics best suited to your particular needs.

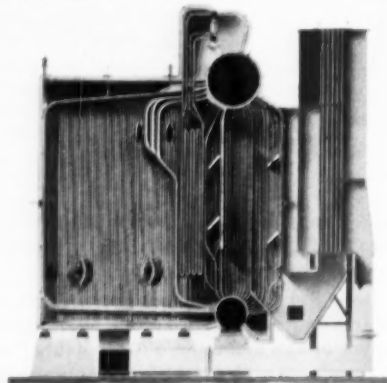
Of course there are other C-E two drum Vertical-Unit Boilers available for pressures up to 1400 psi and temperatures up to 960 F. Shown here are but four popular members of the C-E family of Vertical-Unit Boilers—a family which has achieved a wide measure of acceptance using all types of fuel.

*Please feel free to call on us for further detailed information. Catalogs are available upon request.*

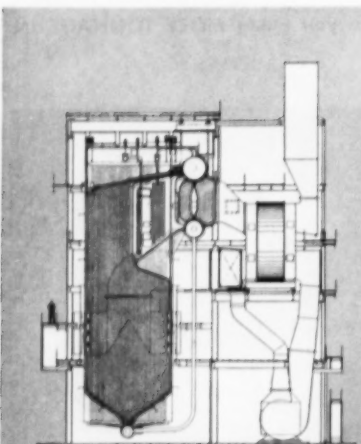
B-922-B



**C-E Package Boiler — Type VP** Completely shop assembled . . . available in fourteen sizes from 4,000 to 40,000 lb capacity . . . pressures to 500 psi. Available with integral console control panel, this unit contains more water-cooled area per cubic foot of furnace volume than any other boiler of its size and type. It can be equipped with any of several approved burners.

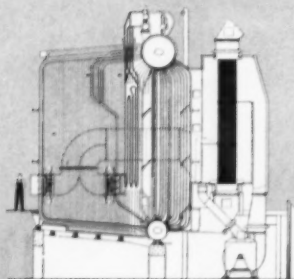


**C-E Vertical Unit Boiler — Type VU-55** Available in six sizes . . . capacities from 50,000 to 120,000 lb steam per hour . . . designed for two pressure ranges, 250 psi and 500 psi, and total steam temperatures up to 750 F. This double cased, gas-tight unit is equipped with tangential burners. A large (60-inch) steam drum assures generous water capacity and steam reservoir space. Tangent tube waterwalls offer complete furnace protection, minimizing maintenance.



**C-E Vertical Unit Boiler — Type V2**

This unit is available for capacities from 200,000 to 600,000 lb per hr. It can be designed for pressures up to 1400 psi and for temperatures to 950 F. Tilting tangential burners, providing superheat control, are standard equipment although horizontal burners are available, if desired. A double, gas-tight casing assures lifetime tightness and minimum heat loss. Heat recovery equipment can be furnished as desired.



**C-E Vertical Unit Boiler — Type VU-50B**

This unit is available for capacities from 50,000 to 400,000 lb per hr—pressures to 1400 psi and temperatures to 950 F. This bottom-supported design uses tilting tangential burners providing effective superheat control. Horizontal burners can be furnished if desired. Heat recovery equipment as required. This unit makes available to industrial installations a standard of performance comparable to utility practice.

## COMBUSTION ENGINEERING

Combustion Engineering Building  
200 Madison Avenue, New York 16, N. Y.



STEAM GENERATING UNITS • NUCLEAR REACTORS • PAPER MILL EQUIPMENT • POLYMERIZERS • FLASH DRYING SYSTEMS • PRESSURE VESSELS • HOME HEATING AND COOLING UNITS • DOMESTIC WATER HEATERS • SOIL PIPE





Function of "impeller" design is agitation thru stirring. Results: Cake scour and uneven formation; vacuum loss at thin sections near the periphery of disc. (Other methods included pipes for air and steam bubbling.)



This "rake oscillating agitation" design (from drum filters) is equipped with upright pieces of various shapes to increase agitation. The result: Cake scour and uneven formations due to direction of thrust.



The Eimco Agidisc method now used provides agitation straight-up between the discs, giving the many advantages listed in text at right.

## EIMCO AGIDISC FILTERS HAVE EXCLUSIVE ADVANTAGES

Eimco Hy-Flow Agidisc Filters give you these important advantages:

- 1) Even cake distribution without segregation.
- 2) Uniform thickness and dryness. 3) Higher tonnage capacity per square foot of filter area. 4) Drier cake.
- 5) Clean discharge. 6) Longer media life. 7) Lower maintenance costs.

After Eimco pioneered the agidisc filter, other manufacturers tried to match its performance by adding attachments to their existing filters.

Sketches at left readily show disadvantages of makeshift agitation.

The Eimco Agidisc is NOT a "patched up" version of other filter designs with doubtful operating merits. It is an integral unit. Scientific planning went into its distinctive design. Advantages were test-proven before it was marketed.

Confirmation that these filters are producing the advantages for which they were designed, is being received every day from Eimco Agidisc users.

## THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

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B-217



Bethlehem Hollow makes the rock fly. This scene was typical during early construction of Massachusetts Turnpike.

## Biting Into Granite on the Massachusetts Turnpike

Section 31 of the Massachusetts Turnpike, a 6.09-mile stretch between Hopkinton and Framingham, presented a formidable obstacle to drilling crews—the removal of 822,300 cu yd of granite and other hard rock. Yet thanks in part to Bethlehem Hollow Drill Steel, fitted with carbide-insert bits, the drilling of hundreds of blast holes was performed in routine fashion.

The contractor for this phase of the 123-mi cross-state express highway was The Savin Construction Corporation, East Hartford,

Conn. They used Bethlehem Hollow in 1¼ in. rounds in wagon drills, and 2 in. rounds in larger drills, to make blast holes ranging in diameter from 2½ in. to 6 in., and in depth from 8 ft to 38 ft.

Bethlehem Hollow can be counted on for steady, low-cost-per-foot-of-hole drilling. This is because Bethlehem Hollow is rolled from a grade of steel which is specially selected for its resistance to fatigue. It has a uniform hole, centrally located in the bar. In addition, Bethlehem Hollow has a wide

quenching range, and is easy to heat-treat for the proper balance of toughness and wear-resistance, resulting in long-wearing threads and strong shanks.

Bethlehem Hollow comes in carbon and ultra-alloy grades, in rounds, hexagons and quarter-octagons. It is normally furnished in lengths of from 18 to 25 ft, though it can also be supplied in longer lengths.

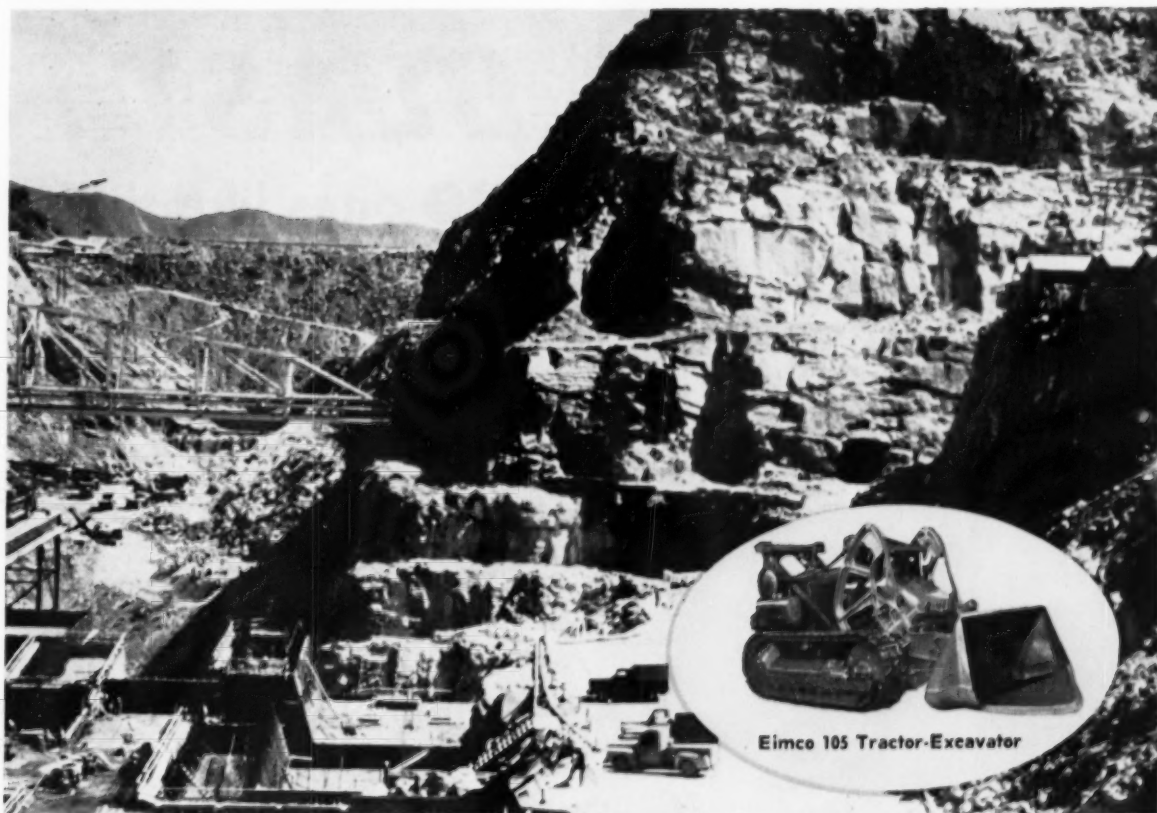
**BETHLEHEM STEEL COMPANY**  
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

**BETHLEHEM HOLLOW DRILL STEEL**

**CARBON AND  
ULTRA-ALLOY**





Eimco 105 Tractor-Excavator

## INDIA - EIMCO 105's KEEP GRUELLING SCHEDULE

Two Eimco 105 Tractor-Excavators have each worked 8,000 hours in 12 months to keep progress on schedule at a huge dam project in India.

The machines have received intelligent maintenance and repairs have been small.

Eimco 105 Tractor-Dozer



At work on diversion, penstock and highway tunnels, trained Indian crews operating the 105's are doing an excellent job of tunnel driving. In some instances, advance for the size of tunnel being excavated may establish new world records.

"Eimco 105's are preferred equipment to use for tunnels of this type," says one official of a contracting firm. "The transmission, clutches and drive on both machines have not been touched in 8,000 hours of operation. They are in good condition and we expect them to last many more years."

Have you considered why the Eimco 105 is "preferred equipment" to contractors of huge dam, tunnel and road projects in the export market?

It's because their dependability is reflected through their engineered strength to stay on the job around the clock — day in and day out.

The Eimco 105's dependability eliminates the necessity of a sizeable parts depot. Eimco's are built to 100,000 hour standards for service in remote areas. Time saved by Eimco's working continuously with no down time for repairs is a big factor in selecting equipment.

Conditions being equal, Eimco 105's will produce more at less cost and in less time than comparative equipment. Let Eimco show you how this versatile unit can outperform and out-work heavier, more expensive units.

See the Eimco 105 before you buy any crawler tractor equipment.

**THE EIMCO CORPORATION**  
Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

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B-214

# **BLAST!**

## **BIG ones like this**



or small ones, too! . . . . .



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**BORON CARBIDE**

NORTON PRODUCTS: Abrasives • Grinding Wheels  
Grinding Machines • Refractories  
BEHR-MANNING PRODUCTS: Coated Abrasives  
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## **More Economically with Norbide<sup>®</sup> Pressure Blast Nozzles**

THERE'S a NORBIDE Nozzle available to give you exactly the type of cleaning stream you need — from a broad stream for large areas to a pencil-thin stream for cleaning small openings. And NORBIDE Nozzles — lined with the hardest manufactured material commercially available — maintain stream contour, last longer than any other nozzle made and deliver maximum blasting efficiency at minimum cost per hour.

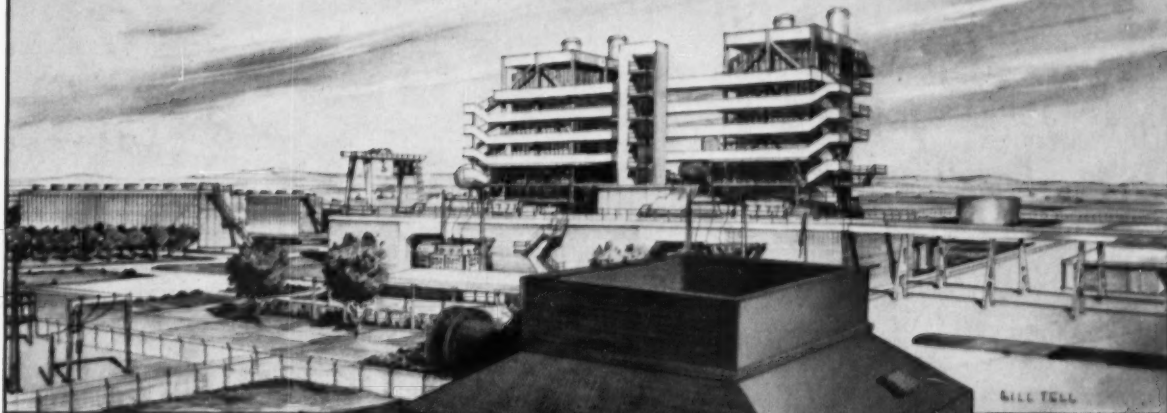
For full details on cost-cutting NORBIDE Nozzles, write for your free copy of Form 543.

**NORTON COMPANY**  
41 New Bond St., Worcester 6, Mass.

**NORBIDE<sup>®</sup> . . . The Longest Nozzle Life You Can Buy**



# SALT RIVER POWER DISTRICT AGUA FRIA STEAM PLANT



## I-R CONDENSERS AND AUXILIARIES

**will serve new, ultra-modern semi-outdoor plant in Arizona**

**T**O SERVE the booming "Kilowatt Country" of Arizona and vicinity, the Salt River Power District is building a new 200,000 kw semi-outdoor steam plant of completely modern design. This Agua Fria Steam Plant, under construction by The Bechtel Corporation, will feature the latest advances in power plant technology, including closed-circuit television for boiler room supervision.

Each of the station's two 100,000 kw turbo-generator units will be served by an Ingersoll-Rand 50,000 sq. ft. rectangular surface condenser. Auxiliary equipment includes I-R condensate and circulating pumps and steam-jet ejectors.

Here, as in all Ingersoll-Rand steam plant equipment, maximum service continuity and long-range dependability are primary factors in design and construction. The performance of similar equipment, in

leading power plants from coast to coast, has demonstrated its exceptional life-expectancy in continuous, heavy-duty service. Ask your I-R representative for full details on the equipment best suited to your needs.

### INGERSOLL-RAND EQUIPMENT FOR THE AGUA FRIA STEAM PLANT —

- 2 Rectangular Surface Condensers**, each 50,000 sq. ft. single-pass, vertically divided.
- 2 Steam-Jet Ejectors**, twin-element, two-stage with surface type inter- and after-condensers.
- 4 Vertical Condensate Pumps**, each a three-stage unit rated 1400 gpm, 250 ft. head.
- 4 Horizontal Circulating Pumps**, each a single-stage double-suction unit rated 41,000 gpm, 57 ft. head.

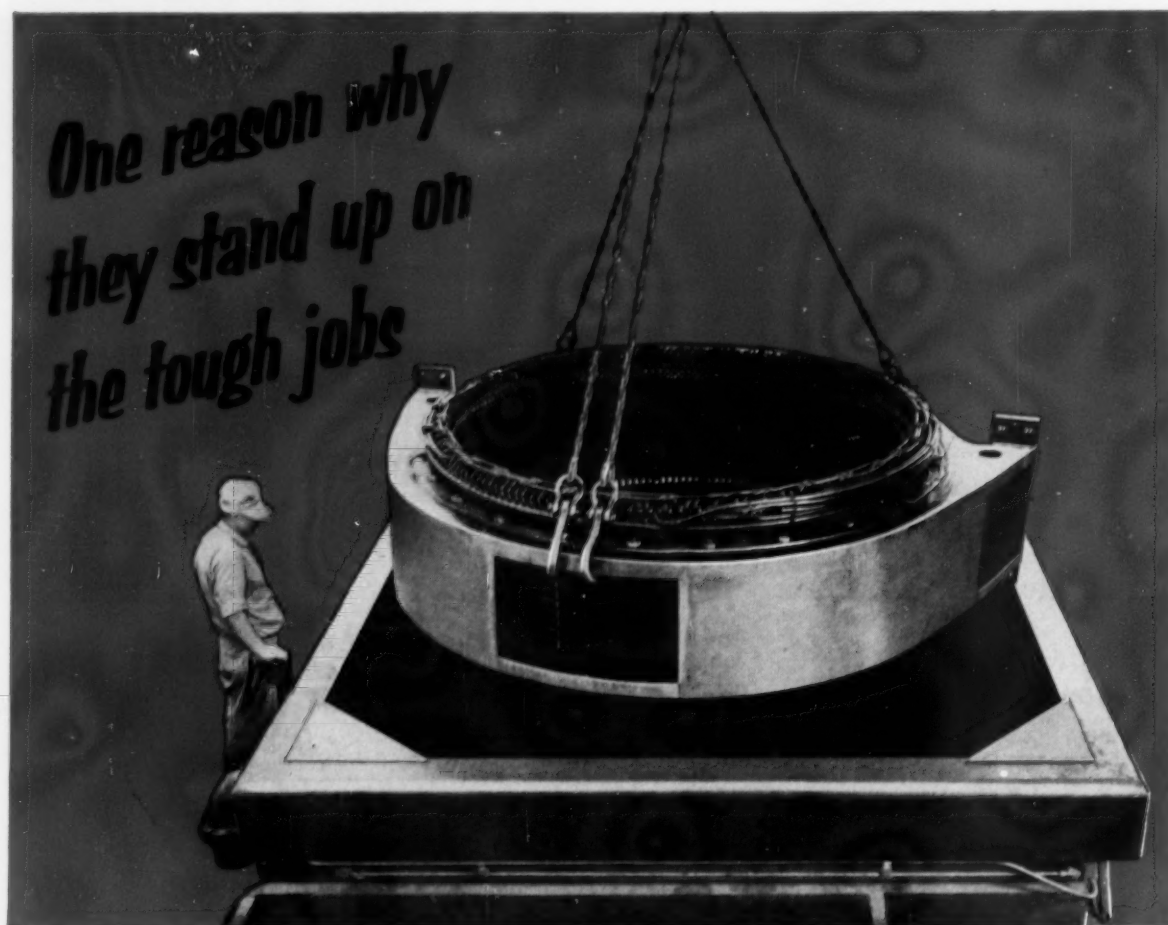
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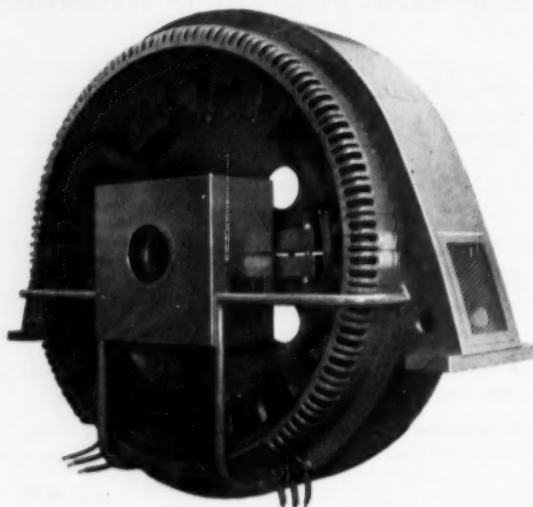
# Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y.

COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO-BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • DIESEL AND GAS ENGINES



## ELLIOTT SYNCHRONOUS MOTORS



The same Elliott synchronous motor now completed and ready to be shipped to a northeastern chemical plant where it will drive a compressor. Motor is rated at 3500 hp and 300 rpm and has an enclosure over collector assembly for pressure ventilation.

RG-15

A COMPLETE STATOR DIP IN THE INDUSTRY'S LARGEST INSULATING VARNISH TANK is an essential step in the special painstaking coil insulation process for synchronous motors that operate in paper mills, chemical plants, power stations and rubber mills where severe moisture, chemical fumes, abrasive or conducting dust conditions prevail. Unlike the usual spray method of varnish application, complete penetration and coverage is assured by complete immersion. After baking, the coil ends are given two additional dips and bakes to further protect against the entrance of moisture, chemical fumes, dust, etc. Better coil insulation is one of a number of "extras" that help make Elliott synchronous motors first choice for compressor, ball mill, rolling mill, pulp grinder, and many other tough service drives.

Ask your Elliott field engineer for details or write Elliott Company, Ridgway Division, Ridgway, Pa.

**ELLIOTT Company** 

STEAM TURBINES • MOTORS • GENERATORS • DEAERATING HEATERS • EJECTORS • CONDENSERS • CENTRIFUGAL COMPRESSORS • TURBOCHARGERS • TUBE CLEANERS • STRAINERS

# LQ600 VALVES

- NO LEAKAGE • NO EROSION
- NO WIRE DRAWING
- ... In 100,000 applications  
and 5 years of tests

Famous LQ600 Bronze Valves, with revolutionary Brinalloy seats and discs, now solve maintenance problems in a new wider range of services!

The lower pressure LQ600-150 made valve history during five years of cost-cutting use in a big variety of installations, ranging from "normal" to "exceptionally severe."

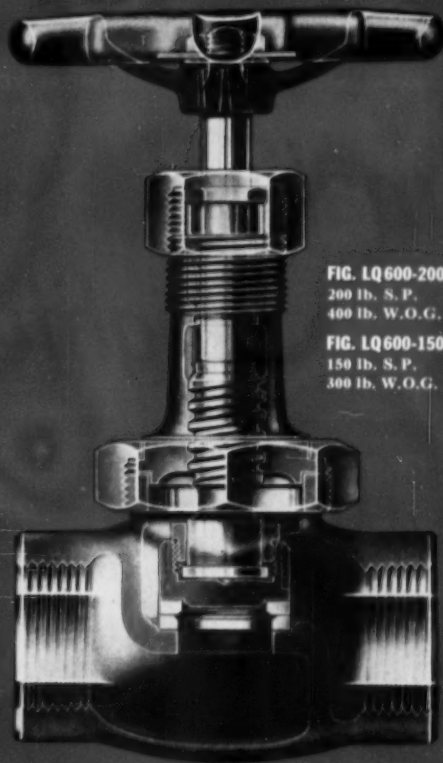
Now the higher pressure LQ600-200 offers all the same proved features—plus a stronger body and bonnet of exclusive Lunkenheimer S-1 Bronze. It has a total temperature rating of 550°F.

It will pay you to specify and install LQ600 in your toughest 150 and 200 lb. services. New Brinalloy seats and discs resist wear and corrosion to an amazing degree—far greater than 500 Brinell Stainless Steel... even outwear case hardened Stainless Steel exceeding 1000 Brinell. The flat seats and discs are micro-optically lapped to a perfect fit—and brazed in to stay.

Call your Lunkenheimer distributor  
or write The Lunkenheimer Company,  
Box 360, Cincinnati 14, Ohio.

**BRONZE • IRON • STEEL • PVC**

**LUNKENHEIMER®**  
THE ONE *Great* NAME IN VALVES



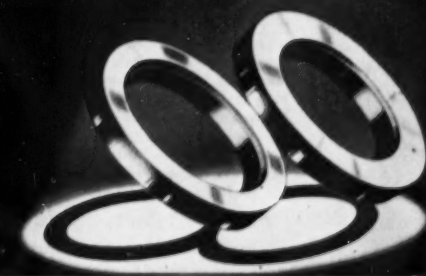
**FIG. LQ600-200**  
200 lb. S.P.  
400 lb. W.O.G.

**FIG. LQ600-150**  
150 lb. S.P.  
300 lb. W.O.G.

## NOW AVAILABLE FOR

200 LB. S.P. 550°F. 400 LB. W.O.G. and  
150 LB. S.P. 300 LB. W.O.G.

## APPLICATIONS



**BRINALLOY\* SEATS AND DISCS**

\*Patented Alloy—TM Reg.

L 554-24

# Smaller!

# Lighter!

HANSEN SERIES RL  
\* \* \*  
EFFECTIVELY HANDLES  
MORE VOLUME THAN ANY  
OTHER COUPLING OF  
EQUAL DIMENSIONS

HANDLES ANY  
JOB WITH FITTINGS  
FROM  $\frac{3}{4}$ " TO  $\frac{1}{8}$ "  
FROM THE AIR  
LINE TO THE  
AIR TOOL

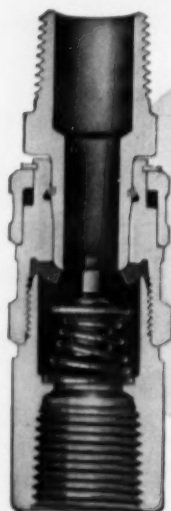
## HANSEN

SERIES RL  
QUICK-CONNECTIVE

RING-LOCK  
COUPLINGS



Relative size of ordinary  
coupling required for effective  
handling of same volume



Cutaway view of  
Hansen Series RL  
Coupling. Note simplified  
construction with minimum  
number of parts. Locking  
ring in Socket enters groove  
in Plug when Coupling is  
connected, insures tight fit —  
provides positive lock.  
Machined from solid bar stock,  
Plug is hardened and  
rust-proofed. Sockets with  
aluminum bodies  
available for use with  
small hand-operated  
air tools.

Hansen Series RL One-Way Shut-Off Couplings will handle any job in your shop using  $\frac{3}{4}$ " to  $\frac{1}{8}$ " connections — from the air line to the air tool. All Hansen Series 2-RL Sockets and Plugs are interchangeable with each other. Likewise all Sockets and Plugs of the slightly larger, greater capacity Series 3-RL are similarly interchangeable with each other.

Consequently, by standardizing on either Hansen Series 2-RL or Series 3-RL Couplings, you eliminate any need for various size couplings in your hook-up — make it easy to keep stock of parts in balance — and hold inventories to a minimum.

Locking ring provides positive lock and assures tight fit. Equipped with automatic sleeve lock.

*Two-Way Shut-Off and Straight-Through  
Couplings also available.*

WRITE FOR CATALOG

SINCE 1915



QUICK-CONNECTIVE FLUID LINE COUPLINGS

### THE HANSEN

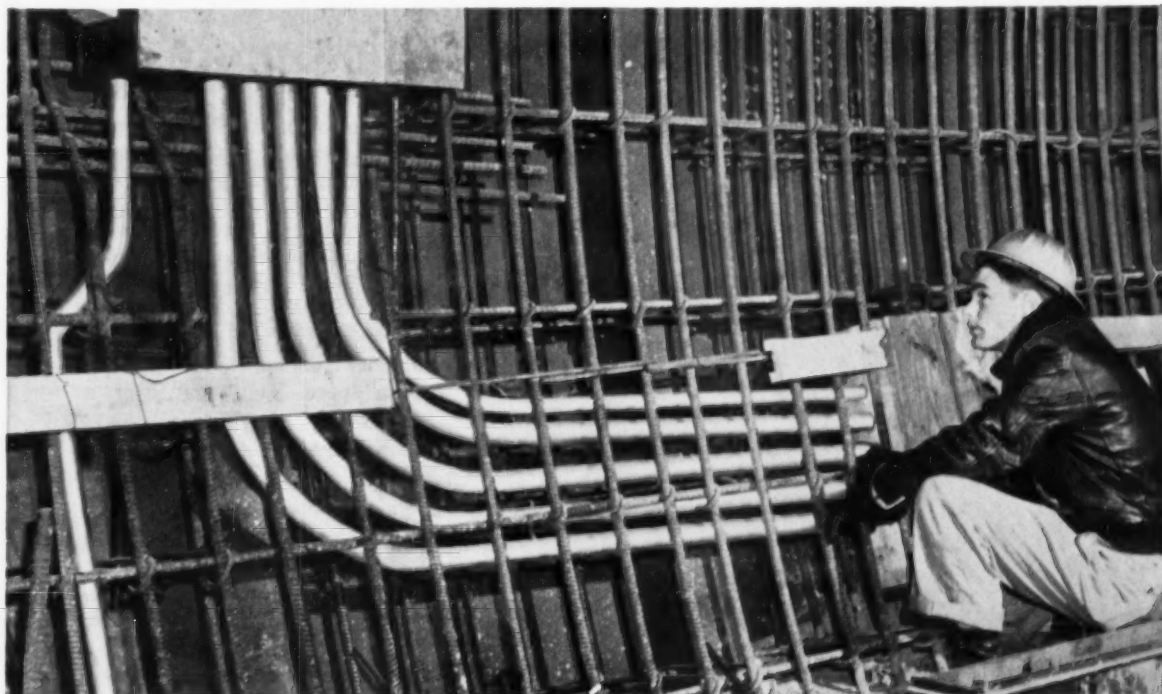
### MANUFACTURING COMPANY

4031 WEST 150th STREET

CLEVELAND 11, OHIO



# Power for the new 7,650-foot Baltimore Harbor Tunnel will be protected by EVERDUR Electrical Conduit



Everdur Electrical Conduit, nominal size 1½", connecting control box to sidewalk manhole—all conduit to be embedded in concrete.



A section of Everdur Conduit in the roadbed slab protects the vital traffic control system and air duct lighting.

**T**HE BALTIMORE HARBOR TUNNEL†, under the Patapsco River, scheduled for completion in 1957, will be the largest "trench-type" tunnel ever built. Twin-tube sections are built on dry land, launched and concreted almost to zero buoyancy, then sunk in place and joined underwater by divers.

Power for traffic signals, alarms, air duct lighting, and shaft lighting circuits for this great tunnel will be protected by Everdur® Electrical Conduit—made from one of Anaconda's copper-silicon alloys. Everdur never rusts—offers high resistance to other types of corrosion. It provides dependable year-after-year protection—wherever water and corrosive atmospheres are a problem—or where conduit must be buried or embedded in concrete. Everdur is also tough—stands up under movement and vibration.

For detailed information, write: The American Brass Company, Buffalo Division, Buffalo 5, New York. In Canada: Anaconda American Brass Limited, New Toronto, Ontario.

\*Reg. U.S. Pat. Off. 561344

†Built by Maryland State Roads Commission, Merritt-Chapman & Scott Corp., General Contractor, Singstad & Baillie, Contracting Engineer, J. E. Greiner Co., Consulting Engineer.

**EVERDUR ELECTRICAL CONDUIT**

**ANACONDA®**  
**COPPER-SILICON ALLOYS**

**CORROSION-RESISTANT • STRONG • NONMAGNETIC • WORKABLE • WELDABLE**

## Adjustable-speed Gýrol Fluid Drive

# controls the flow in catalytic reforming processes

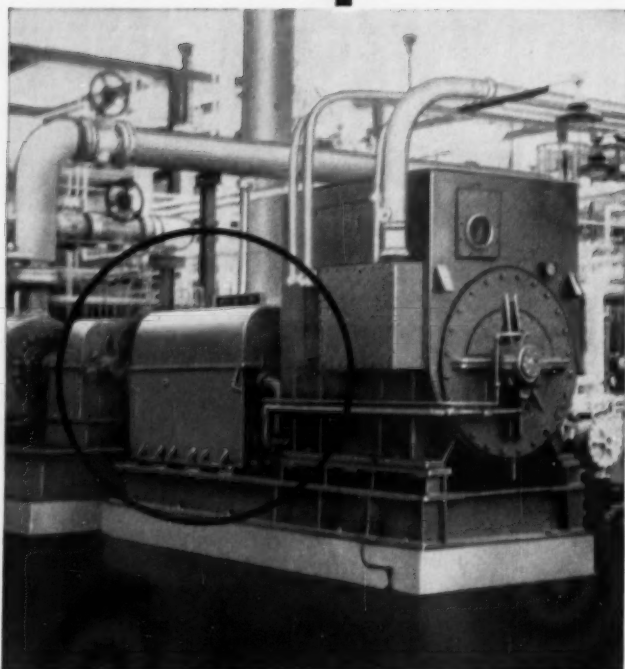


Photo courtesy Union Oil Co. of California

Unit shown is a 4000 hp, 1800 rpm, size 315, type VS, Class-6 Gýrol Fluid Drive equipped to automatically regulate the speed of a centrifugal compressor handling variable-density gases.

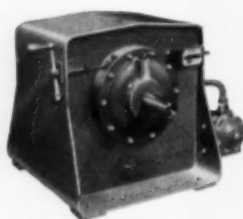
Accurate control of the flow of gases and fluids is the key to the successful operation of a catalytic reforming plant. Because its speed is *adjustable*, American Blower Gýrol Fluid Drives can vary the flow rates of compressors and pumps of all sizes and types — *as needed*. Consider these inherent advantages of Gýrol Fluid Drive:

- Provides infinite and accurate pump speed adjustment over a wide range
- Simplifies starting equipment — provides no-load starting
- Eliminates problem of "gumming" which may occur with mechanical damping
- Saves steam needed for process work through use of squirrel-cage, constant-speed electric motor
- Permits automatic control. Flow rates can be automatically regulated by simple movement of one push-pull control rod

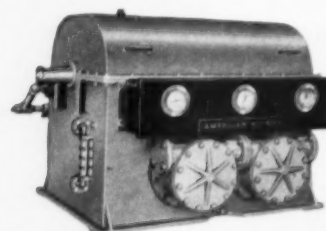
Whatever your method of catalytic reforming, use Gýrol Fluid Drives for flow-rate control. Call your nearest American Blower Branch Office for data.

## Traction-type Fluid Drives

American Blower Type TM, traction-type fluid drives are also available as complete packaged units containing AC motor and built-in Gýrol Fluid Drive. Standard NEMA mounting bolt hole dimensions. 1 to 20 h.p.



Type VS, Class-2, adjustable-speed Gýrol Fluid Drive for industrial applications. Sizes, 1 to 800 hp; speeds to 3600 rpm.



Type VS, Class-6, Gýrol Fluid Drive. Adjustable-speed drive for compressors, pumps, and other high-speed applications. 100 to 12,000 hp; to 3600 rpm.

## American Blower products serve the petroleum industry

- Air Conditioning, Heating, Ventilating Equipment
- Mechanical Draft Equipment
- Industrial Fans and Blowers
- Centrifugal Compressors
- Gýrol Fluid Drives

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# BLOWER



## COMPLETE FILTRATION COVERAGE

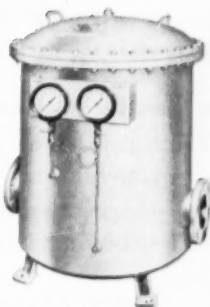
there's a Commercial Filters unit engineered for your filtering job...



Fulflo Filters provide optimum clarity at ultra-high flow rates. For all industrial fluids—including oils, liquid fuels, chemicals, water, compressed air and various gases. Sizes to handle flow rates up to 1,600 gpm. Pressures to 4,000 psi.

Fulflo Filters feature Honeycomb Filter Tubes, the "precision controlled density" element that filters every drop again and again to give you microscopic clarity. Choice of cotton, acetate, nylon, orlon, dacron, dnyel or glass fibres.

Standard models available in steel, stainless steel, rubber lined steel or nickel-plated brass. Custom models engineered to special requirements.



Honan-Crane Filters offer "clean oil" filtration in diesel, turbine, hydraulic, metal-working and quenching operations. Bulk refill models provide depth filtration with cellulose medium for additive oils and Cranite (fullers earth) medium for straight mineral oils. Multi-cartridge models feature six different types of cartridges that may be used interchangeably depending on type and degree of filtration desired. Flo-Pac models, installed in line, handle flow rates up to 900 gpm. All have quick-opening covers for ease in changing refills.



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Diesel and gasoline engines get complete protection against the damaging effects of dirty oil with Michiana Lube and Fuel Oil Filters. Designed for low cost filtration and proven in thousands of installations. "Throw-away" or repackable filter elements. Available in a wide range of sizes and models.



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or engineering help  
covering your  
filtration problem.

## COMMERCIAL FILTERS CORPORATION

MELROSE, MASSACHUSETTS • LEBANON, INDIANA

# how to get the most out of HOLLOW DRILL RODS

The present trend in mining is toward smaller drill holes which require the use of smaller bits and, consequently, smaller hollow drill rod sizes. And that's increased the use of *alloy* steels such as Crucible CA DOUBLE DIAMOND and 4E Hollow Drill Rods.

These new alloy rods have proved themselves on many jobs by lengthening rod life, cutting drilling costs. But they are not unmixed blessings, for they will give a good account of themselves only if they are handled properly. Hammer and tongs blacksmithing isn't enough. Alloy rods demand greater care in forging, upsetting and heat-treating.

## Should You Use Carbon or Alloy Rods?

There's no one answer to that question, unless it is *use the rod that best fits the individual job*. Gen-

erally, air-feed jackhammers and other small, light drills benefit from the use of alloy drill rods. For alloy rods have greater resistance to fatigue, higher elastic limits — important where smaller rod sizes are used.

## Rod Stiffness . . .

Rigidity or stiffness can only be increased by enlarging the cross section of the rod. If you decrease the cross section you'll get more whipping no matter what type steel you use, or how you heat treat it. Therefore, don't use a  $\frac{7}{8}$ " hexagon alloy rod when you've been using a  $1\frac{1}{4}$ " round carbon rod, unless an increase in flexing and less stiffness is unimportant.

## Abrasion Resistance . . .

The higher the hardness the better a drill rod will stand abrasive wear. Alloy rods have the advantage in this respect, for they can be heat-treated to higher hardnesses than can carbon rods.

## Notch Effect . . .

Notch effects caused by failure to overlap heats in treating shanks, or those caused by careless handling, chain marks or corrosion pits all cause rod failure. Alloy rods are more resistant to these nicks or notches than carbon steels, but when they do occur failure can be more rapid.

The answer to better drilling is simply this: choose the right drill rod, and then give it reasonable and proper care.

And for the *right* carbon or alloy hollow drill rods — in the sizes, shapes, and grades you need — Crucible is the place to go. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*



# CRUCIBLE

first name in special purpose steels

## Crucible Steel Company of America



## ON THE COVER



**B**UILT by R. G. LeTourneau at the Breque of the Army Transportation Corps, the 101-ton carrier can right a capsized or stranded landing ship and move it to shore or into deeper water. Its lifting gear consists of a series of hoists. The unit is 75 feet long, 38 feet wide, 22 feet high and travels on four pneumatic-tired wheels 10 feet high. It is operated by electric power furnished by two diesel-engine generators. A driving motor is built into the center of each wheel, totally enclosed and under air pressure to exclude water. Army records show that 90 percent of the landing craft incapacitated during World War II were victims of rough seas and high winds rather than of enemy action. The new retriever is intended for rescuing those that experience a like fate. The cover picture shows a vessel being brought ashore. The smaller picture on this page shows how the carrier dwarfs an automobile and man underneath it.

## IN THIS ISSUE

**C**OMMON salt ranks among our leading mineral products, its annual output exceeding 15 million pounds, with Michigan and New York the two top states. The recovery of salt from buried deposits is unusual in that it can be either mined in the solid state or dissolved with water and pumped to the surface as brine. Our leading article describes both types of operation.

**T**WENTY underwater transportation tunnels, each consisting of two tubes, now link New York's Manhattan Island with surrounding areas of land. Next year Tube No. 41 will go into service. It is the third tube of the Lincoln Tunnel, a vehicular Hudson River crossing. Rendered necessary by mounting automobile travel, it will make the Lincoln the first vehicular tunnel anywhere with three tubes and six traffic lanes. Now in its fifth year of construction, the segmented iron shell is in place and finishing of its interior is in progress. The first part of a 3-part article on the \$100-million bore starts on page 266.

**A**PICTORIAL spread on pages 264-65 shows how paperboard cartons are slipped over bulky products and sealed with the aid of air power. Diversified applications of compressed air are illustrated on pages 272-73.

# Compressed Air Magazine

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G. W. MORRISON, *Publisher*

ANNA M. HOFFMANN, *Associate Editor*

R. J. NEMMERS, *Assistant Editor*

J. J. KATARBA, *Business Mgr.*

D. Y. MARSHALL, *Europe*, 243 Upper Thames St., London, E. C. 4.

F. A. McLEAN, *Canada*, New Birks Building, Montreal, Quebec.

C. H. VIVIAN, *Editor*

J. W. YOUNG, *Advertising Director*

FRANCIS HARTMAN, *Circulation Mgr.*

R. W. SAPORA, *Foreign Circulation Mgr.*

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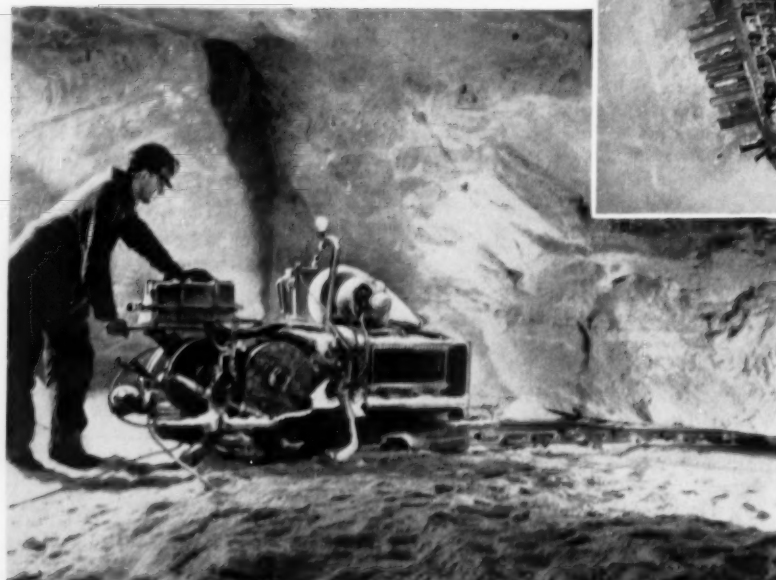
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## Worth Your Salt

How a Mineral with 14,000 Different Uses Is  
Extracted from the Earth and Processed

ROBERT G. RUBEY



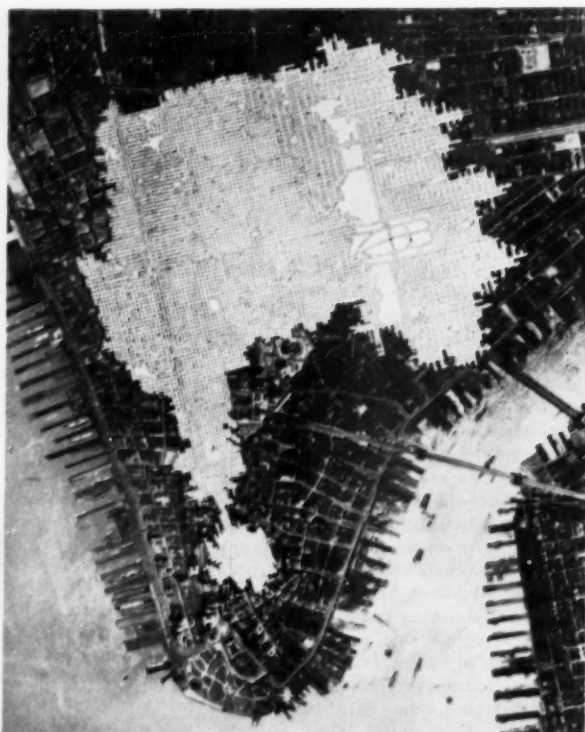
### FIRST MINING STEP

Mining begins at Retsof with the careful preparation of the face of the salt vein. First the ingenious machine shown above saws a horizontal slot 10 feet deep and 55 feet across at floor level. Then rows of holes are drilled at four levels, loaded with dynamite and detonated. The average shot breaks out about 250 tons.

**S**ALT has a history that goes back as far as that of man who discovered more than 5000 years ago that it would keep his food from spoiling. Centuries later the Roman soldier received a percentage of his pay in salt. That allowance was known as his *salarium*, from which stems the English word salary and which explains the familiar saying: "Not worth his salt." Wars have been fought over the vital mineral, and the destinies of peoples have been changed because of a lack of it. The complete story of the part salt has played in the world in the centuries gone is a fascinating one and has been told at length in our November 1945 issue.

Not only is the history of the mineral long and interesting, but so will its future undoubtedly be. The supply is practically inexhaustible. There are more than 350,000 cubic miles of known rock-salt deposits. In this country New York State alone produces annually nearly 3,000,000 tons of different grades and ranks second only to Michigan in this respect. The salt found in New York lies mostly in seven strata which presumably were laid down when an ancient sea or seas evaporated in ages past.

Salt in its many forms has a rapidly expanding list of more than 14,000 applications. There is common table salt, and salt used by railways for their road-



### AS BIG AS LOWER NEW YORK

International's rock-salt mine at Retsof, N. Y., is the largest in the western world. To give an idea of the extent of its underground workings, an outline of them is shown superimposed on an aerial photograph of the lower section of Manhattan Island. The dots and small enclosed figures indicate pillars left for support. Some of the passageways run unobstructed for 1½ miles.

beds. Tons of it enter into chemical processes, food packing and the textile industry. It helps to remove snow in winter and to lay dust in summer. The uses to which it can be put depend upon the grades which, in turn, depend upon the process of production.

Basically, salt is obtained in two ways: by mining or by the evaporation of brine from wells. Leaders in New York's huge output are the International Salt Company at Retsof, south of Rochester, which mines its deposit, and the Watkins Salt Company at Watkins Glen on the lower tip of Lake Seneca which practices the well or evaporation method.

International's mine at Retsof is the biggest in the Western Hemisphere. It was started in 1884 and has grown to the point where it now provides more than 5000 tons of rock salt daily. The tunnels and chambers cover an area exceeding 1500 acres and have a perimeter of 15 miles. Under certain conditions mining is more economical than the evaporation process. However, to be feasible the workings must be dry and the shale or rock surrounding the deposit must be impervious to prevent



#### LOADING AND HAULING

Temporary tracks are laid in each corridor being mined (right). Cars are backed in by one of the 30 electric locomotives in use, and power is supplied by a long cable instead of a trolley wire. Loading is done mechanically, as shown, and when several cars have been filled they are hauled to the main line and made up into long trains. Powerful electric storage-battery locomotives take over there (above) and haul 50 or more cars to gravity "yards" near the foot of the shaft.



leakage. Also, the bed must yield a product that is not less than 95 percent pure. The Retsof mine meets both requirements—it has a nearly pure mineral and is exceptionally dry.

After a 1063-foot descent to the shaft bottom, you enter an "underground plant"—the mining headquarters—which is carved out of solid rock salt and is at a comfortable unvarying 63°F temperature. It is complete with an office and a machine shop. The latter maintains the mining equipment, hundreds of mine cars and some 30 electric locomotives. A ride on one of the many rail lines will bring you to the area where salt is produced much in the same way as coal. The panel room-and-pillar system is used, which allows all but 30 percent of the deposit to be mined. A panel is made up of twenty rooms separated by the pillars of salt that are bypassed to support the roof. Timbering or shoring is unnecessary.

Preparing the face for blasting involves a series of steps the first of which is called undercutting. This is done by a machine with an 11-foot cutter bar which resembles that of a chain saw. It cuts a horizontal relief seam at floor level

from wall to wall of a room with tooth-like bits of tungsten carbide set in steel shafts. The machine is equipped with a set of self-powered tracks to facilitate moving it from one face to the next. Undercutting is followed by drilling and charging the holes. For the drilling job International has selected a crawler-mounted machine provided with two T-bar hydraulic booms that enable it to bore four holes simultaneously. The auger-type twin-fingered bits are carbide tipped. In four setups the unit can drill 64 twelve-foot holes.

In the drill-round pattern used by International the holes are arranged in four rows. The upper one is started as close to the top of the face as the machine will permit. These holes are

angled into the roof. The bottom row is begun at a height of 4½ to 5 feet and terminates about 20 to 24 inches above floor level. The two center rows are nearly parallel with the floor.

When these preparatory operations are completed, powdermen charge the holes with an ammonia dynamite. The loading ratio is 0.4 pound per ton of salt. The charges are then primed with detonators, and bags of rock salt are tamped in to cap the holes. Wires to shoot the round are strung to the blasting board at one of the firing stations and the various rounds are detonated by the foremen at the end of the regular working day. All power in the mine is turned off when the lead wires are joined to their respective firing wires. When



the foremen indicate that the connections have been made, current is again switched on and the face is blasted. As much as 250 tons of rock salt is brought down and left to be carried away by the next shift.

Large hydraulic-electric loaders start the big job of removing the rock salt and delivering it to graders. It does not take them long to fill a mine car, which can carry up to 6½ tons. Small electric locomotives, each with its own power cable wound on a drum on the "hood," haul the loaded cars to the gathering yards on the main line where they are coupled into trains of more than 50 each to be pulled by two locomotives to a point near the main shaft. There the cars are emptied by a rotary dump which turns each one upside down over a large chute, whence the salt slides into a giant crusher that breaks the larger pieces to within a diameter of ¼ inch.

The newly crushed salt now falls into skips and rides straight up 1292 feet

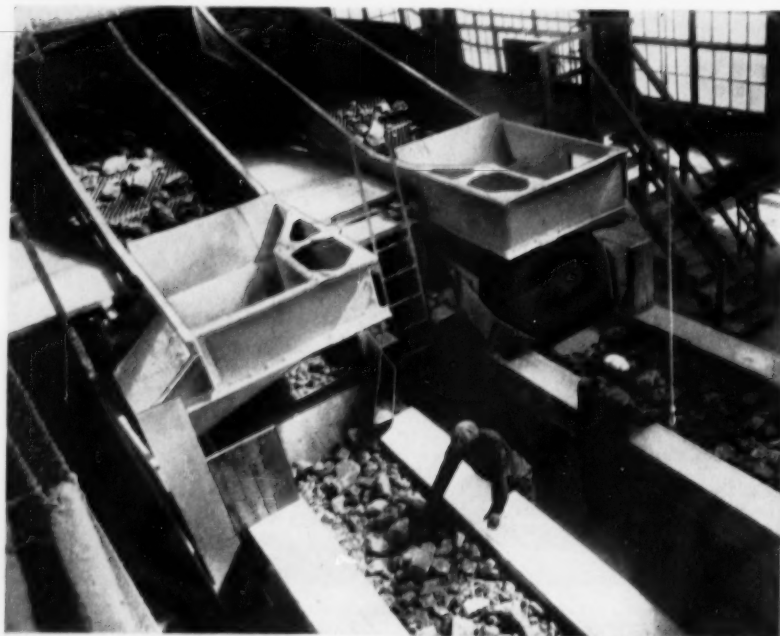
in the main shaft in a matter of 65 seconds. The momentum of the skips is stopped at the end of their travel by a big air brake on the 8-foot-diameter cable drums. Air for the brake and services elsewhere in the plant is supplied by two Ingersoll-Rand compressors, a Type XRB and Class ES. In the tower at the upper end of the shaft the skips automatically dump the salt into a huge hopper from which it is fed onto two large scalping screens. After passing through the latter the salt, which is quite hard, goes through a battery of ball crushers and then over successively finer screens. During the complete operation from the tower of the breaker house through the last screening sequence the material is fed by gravity. Screening and crushing result in four grades of industrial rock salt that temporarily come to rest in their respective bins.

Depending upon the use to which the salt is to be put, it will be bagged or

loaded in bulk form into hopper or box-cars. From the bins it is transported by long conveyors and routed by means of air motor-powered butterfly valves that control the bin gates. Each of the latter has its individual motor to move the valve to the proper position. While in transit, the material to be shipped in bulk is automatically weighed in 50-pound lots by an Eagle Counter weigh-beam scale that is an integral part of the belt and stops it when the desired quantity has passed over it. Cars are gravity loaded.

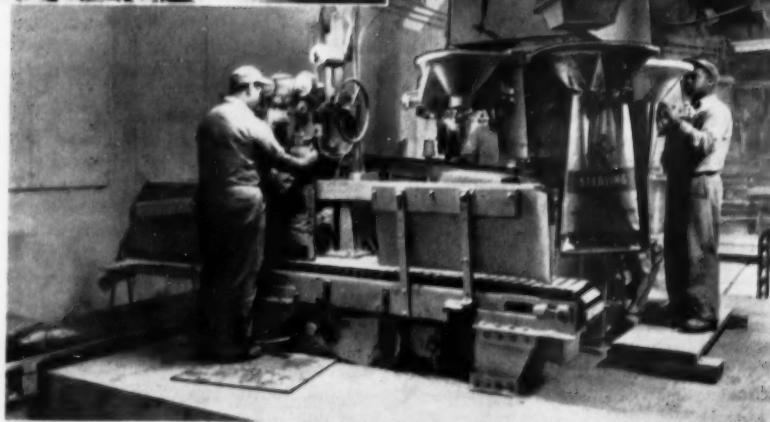
The salt to be distributed in bags travels by gravity to a unique filling machine that was designed by International. It has four hoppers which revolve around the main body of the unit, and as the bags are placed manually under each one in turn the machine mechanically weighs out the correct amount of salt and deposits it by way of the waiting hopper into the bag. Both the clamps that hold the latter open during filling and the scale gates are operated by compressed air applied through electric solenoids. When the air is released, the bag drops onto a short conveyor and passes through a stitching machine which sews it shut. Loading the bags or bulk material into rail cars completes the work of producing rock salt by the mining method.

About 50 percent of the total annual salt output is obtained from wells which supply brine that is purified and then evaporated in vacuum pans or Grainer tanks. In contrast to mining, this procedure demands large quantities of fresh water, both of which are readily and

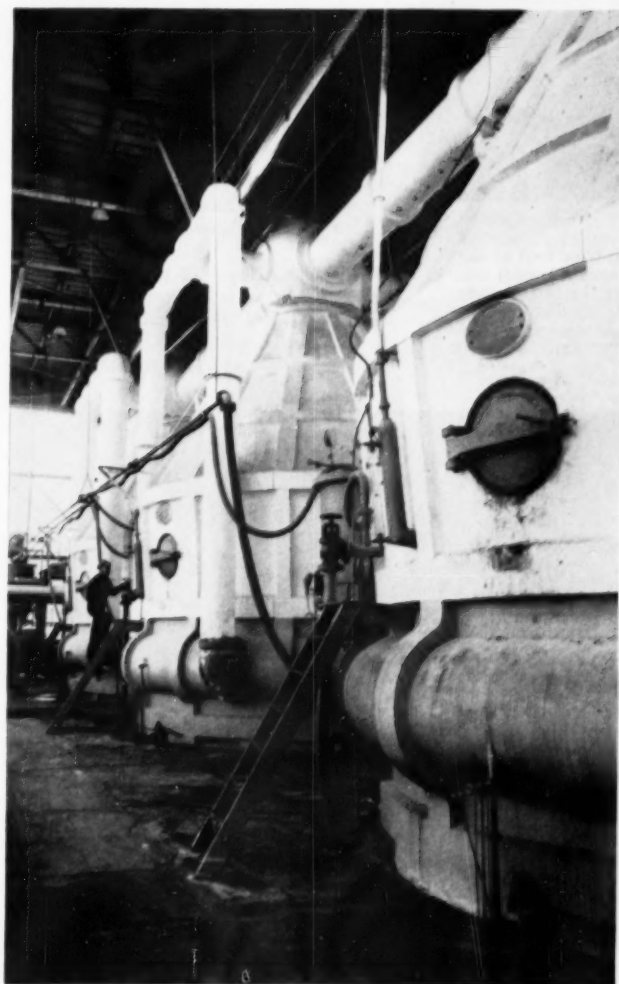
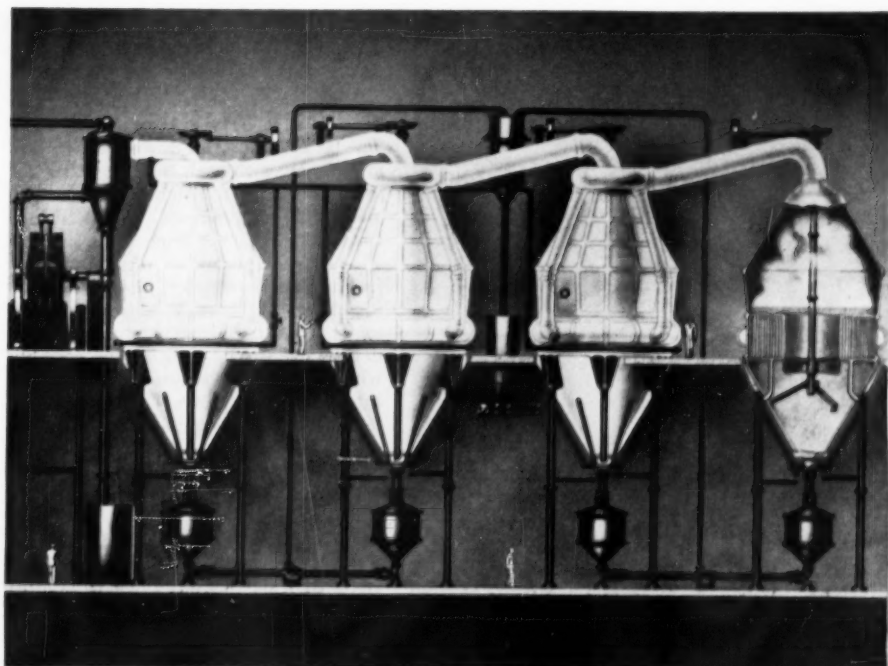


#### GRADING AND PACKING

Crude lump salt is hoisted in skips, which are automatically overturned at the top of the breaker-house tower. The material tumbles down on screens that accomplish primary grading and permit making the first inspection (above). It is then passed through ball crushers and screens to produce four grades of rock salt. Some of the graded material is packed by special machines (right). It flows from bins by gravity, is mechanically weighed and deposited in bags that are stitched across the top when filled and travel on conveyor belts to railway cars. The clamps and weighing gates of the packing machines are controlled by means of solenoid-operated air valves.







#### VACUUM-PAN EVAPORATION

Salt for the table and other uses that require a fine, pure and uniform grade is produced at Watkins Salt Company by the vacuum-pan method. The pans may be installed singly or in multiples operating in series, as diagrammed at the top. Each has three sections: a conical top and bottom and a cylindrical midsection. It contains a belt of copper tubes that surrounds a central well. As brine is poured into the pans to a level slightly above the nest of tubes, vacuum pumps evacuate the domes. The vacuum is increased in each succeeding vessel, thereby permitting the steam vapors from the first one to be used in succeeding ones without reheating. When steam is turned on, an agitator in the lower section of each pan is started. As the brine evaporates and crystallizes, the salt falls into a catcher in the bottom. The process is continuous, and the salt is removed periodically without interrupting it. The Watkins Company uses the 3-unit vacuum pan shown at the left. From there the salt goes to the surge tank seen in the upper-right of the picture above and, next, into the monel-metal Oliver drier in the foreground. This cylindrical drum-type unit is evacuated by suction created by a centrifugal blower, thus extracting moisture from the salt. When the latter has about completed a revolution on the drum it is scraped onto a conveyor and sent to storage areas for further drying.



#### BIG SQUEEZE

This air-operated block press exerts 400 tons pressure and applies heat to salt to form the familiar blocks for livestock. The loose salt drops from a hopper into the press, and in a matter of seconds a warm block slides down the ramp, ready for shipment. Chemicals are added as needed to supplement the diet of cattle in various parts of the country and impart a red, blue or yellow color to some of the cubes, depending upon the additives. A large percentage of the salt produced by the Watkins Company is used for this purpose.

economically accessible to the Watkins Salt Company located as it is on the shore of Lake Seneca. It was started in 1898 by W. W. Clute who has been referred to by many as the "Father of Salt." From the time the first well was drilled, hundreds of thousands of tons of salt have left the plant by boat. For several years the slip has been idle, but that is only because the concern has greatly extended its truck and rail facilities. It now has twelve wells, some

#### GRAINER METHOD

Salt of coarse grade for tanning, coating pretzels and other uses is produced by the Grainer method. Brine from settling tanks is poured into long, shallow tanks in which copper steam tubes stretch from one end to the other. As evaporation proceeds, crystals form, float to the top, grow in size and pyramidal shape and finally sink. Unlike the pan method, agitation is not required. At regular intervals mechanical rakes pull the salt out onto a conveyor that carries it to a drier.



of which reach depths of 1800 feet, within a  $1\frac{1}{2}$  mile radius of the main plant.

A salt well operates on the principle that brine is heavier than fresh water. The latter is pumped down into the bed and dissolves the salt, forming a nearly saturated brine solution. Then water, along with compressed air, is forced into the well to bring the brine to the surface. This is accomplished at Watkins by the use of three concentric pipes; an outer 6-inch casing through which the fresh water from the lake is pumped into the deposit; a central 4-inch tube through which the heavy saturated solution is lifted and then conveyed to the plant for further processing; and, innermost, a  $1\frac{1}{4}$ -inch line that provides the well with air at 325 psi pressure supplied by two 160-hp Ingersoll-Rand Type 10 steam-driven compressors.

When a well is first started its diameter in the salt formation is no larger than that of the outer casing and it is left idle until the brine solution has reached a saturation point of 95 percent. Then, as more and more salt is dissolved and pumped out, it grows in bottom size and production. Unlike in mining, the salt need not be 95 percent pure because the impurities will not dissolve in the water and will settle to the bottom. For this reason high-pressure air is used in preference to deep-well pumps which would agitate the sediment and bring it to the surface. However, an excess of impurities makes the evaporation method economically impracticable.

Through a maze of pumps and pipe lines the brine is delivered to settling tanks where a small quantity of lime in solution is added to it. Other chemicals such as soda ash may be included,

depending upon the chemical analysis of the brine. The chemicals cause the foreign matter to float to the top, to gather and eventually to settle. At Watkins there are four 100-foot tanks with sloping bottoms. The brine flows slowly to the deeper end of the first, crosses to the shallow end of the next where it moves to the deep end and so on, the cycle repeating itself in the four tanks. The purified brine is then stored in three cylindrical outdoor settling tanks until it is needed. The tanks are cleaned periodically, but otherwise the process is continuous.

At this point the brine goes in one of two directions, depending upon its use in the form of salt. Table salt and that for industrial applications, which must be fine, uniform and of high purity, is processed by the vacuum-pan method. The type of "pan" in service has three functional sections: a conical dome that is evacuated to reduce the amount of steam required for evaporation; a cylindrical middle section slightly smaller in diameter at the top than at the bottom; and a conical lower part complete with an agitating fan or paddle located where it is widest. The cylindrical section contains a collarlike nest of 1880 copper steam tubes about 4½ feet long and 2½ inches in diameter, leaving a well with an approximate diameter of 10 feet in the center. The plant of the Watkins Company has a battery of three 75-foot vacuum pans that operate in series.

The process itself is quite simple. As the pans are filled with brine to a point

slightly above the top of the steam tubes the domes are evacuated, the vacuum in each succeeding pan being higher than that in the preceding one. In this way the vapors formed by evaporation in one can be used in the next and thus obviate raising the steam to the original temperature. The boiling brine is stirred by the agitators, and as it comes in contact with the tubes and moves down through the wells it becomes more and more concentrated, finally crystallizing and settling in the salt catchers at the bottom. The condensate from the steam tubes is not wasted, but is used for different purposes throughout the plant and thus increases its over-all efficiency.

The salt is removed at specified times by pumps without interrupting operations. The slurry from the pans is collected in one of two surge tanks which allow it to flow at a predetermined rate into the pan of a cylindrical Oliver drier. Watkins maintains two of these evacuated monel-metal screened drums which suck the water out of the salt and then proceed to dry it. A fine mist of water is sprayed on the damp salt after most of the water has been extracted so that the granules will not stick together during the drying process. The warm salt is scraped from each drum just as it is about to complete its cycle and drops onto a belt which carries it to storage. If it is to be used for table salt it goes through another drier, a 40-foot revolving steam-heated drum from which a helical conveyor carries it to screening and packaging stations.

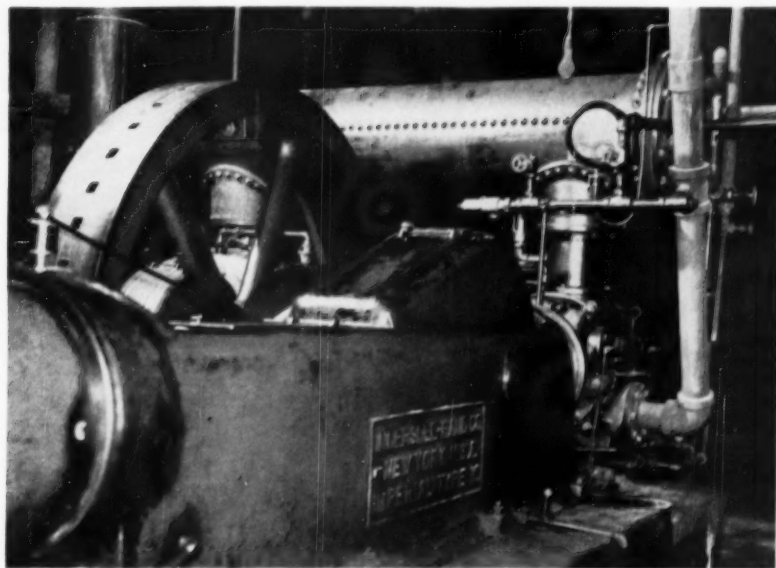
A large percentage of the output is

also made into salt blocks for cattle. In that case it is fed into the hopper of a machine where chemicals such as sulphur, potassium and others may be added in varying quantities, depending upon the area to which the blocks are to be sent. It was discovered some time ago that it is possible to compensate for chemical deficiencies in cattle fodder by putting the needed chemicals in the blocks. The salt, with or without additives, is dropped into the press where it is shaped under heat and 400 tons pressure. The machine is of the air-hydraulic type and obtains its air supply from the Type 10 compressors mentioned previously.

Salt for pretzels, for tanning and for many other industrial uses must be coarser than that for the table, so the brine from the settling tanks is pumped into any one of six Grainer pans. The latter are 125 feet long, 15 feet wide and 2 to 4 feet deep and contain full-length copper tubing through which steam is circulated. As evaporation takes place, minute crystals form in the brine and float to the top. These grow in size as evaporation continues until they eventually settle on the bottom of the tank. The crystals formed by the Grainer method are pyramid-like in shape and float point down—the shape being attributable to their increasing weight, which causes them to sink gradually, and to the fact that they do their fastest "growing" at the surface.

At intervals, hydraulic rakes, which pass under the steam pipes, scrape the wet salt from the bottom of the pans onto a conveyor, which delivers it to a drier. Next it goes to a cooling conveyor and then the product is stored or packaged, depending upon the demand. It may be bagged in 1-pound, 2-pound or large sacks, or in bulk for shipment in boxcars. In the latter form it is weighed during loading by means of a weigh-beam which is an integral part of the conveyor system. The salt from the vacuum pans may also be transported in bulk. Much of it, however, is packaged for different salt distributors throughout the country. It is sent to the boxing room where the containers are mechanically fed to machines, opened, filled and labeled. From the time the brine leaves the well until the salt is ready for the table it is not touched by human hands.

As we have learned, the methods described yield different kinds of salt from the varying deposits. Most of us tend to take the common salt shaker for granted, but the mineral which it holds is an end product of a highly technical industry. Concerns like International Salt Company and the Watkins Salt Company join in meeting the needs of the ever-growing list of consumers of the world's most stable and widely used commodity.

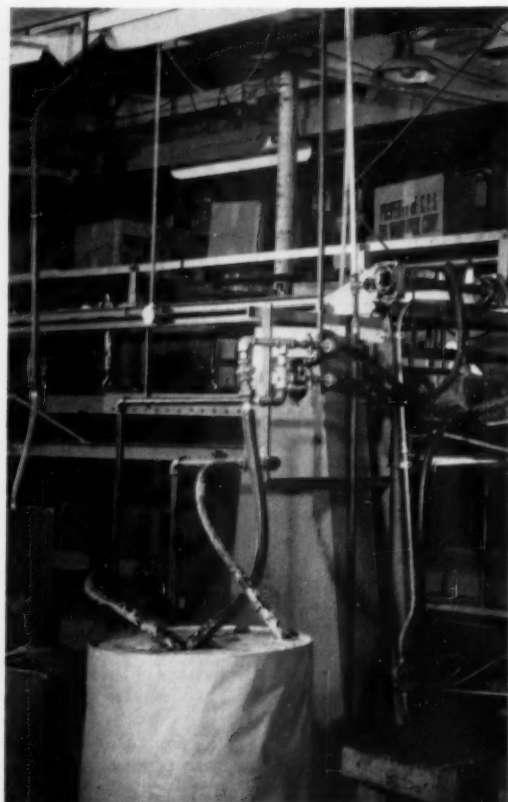


**A SOURCE OF AIR**

The Watkins company operates two Ingersoll-Rand 160-hp compressors to supply air at 325-psi pressure to pump brine from the salt wells to the surface by the air-lift method. The two machines, only one of which is shown, have been in service since 1914 and 1916.

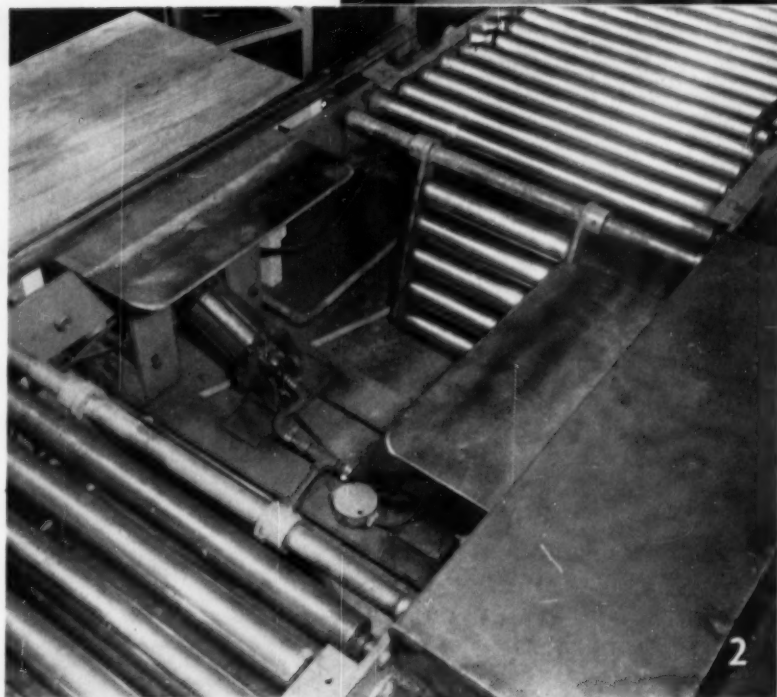


## IT'S EASY TO PACK



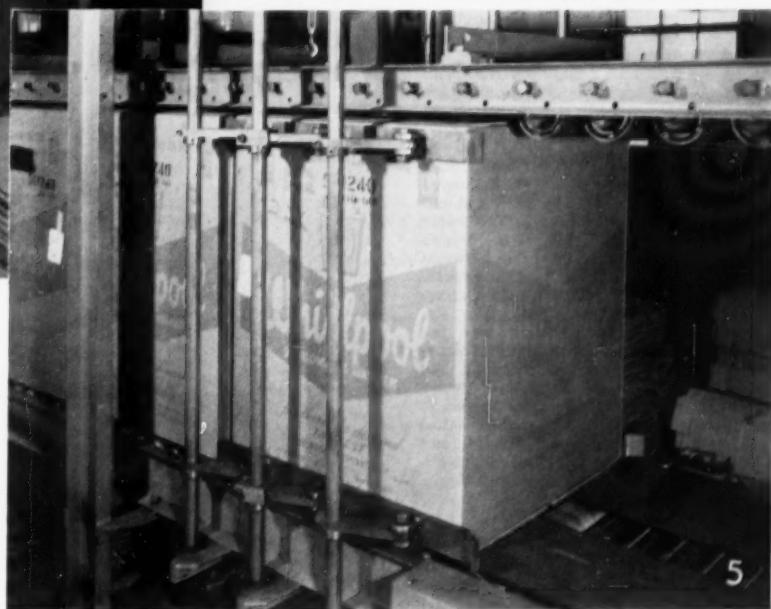
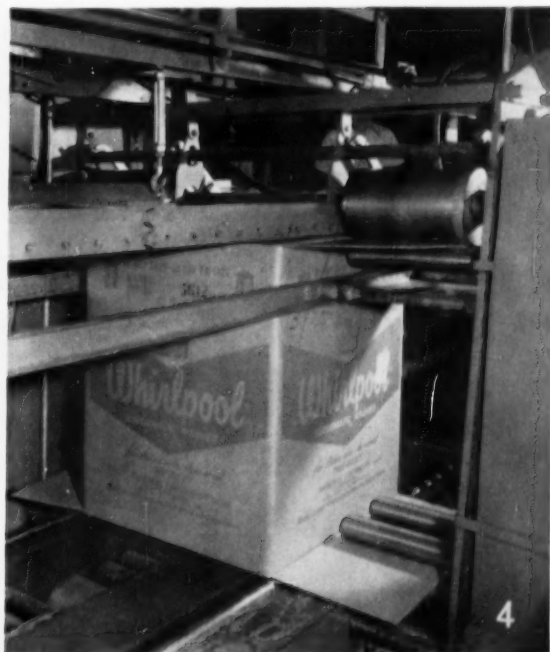
**B**Y MEANS of a new method of packing large manufactured products for shipment, the usual procedure is reversed. Instead of lifting the object and placing it in a carton, the latter is picked up and slipped over the equipment or appliance. The system was designed by Hinde & Dauch, maker of corrugated boxes, to handle one-piece, slotted cartons and is now in use in a plant that turns out washing machines and in another that produces electric ranges, water heaters, refrigerators, etc.

From the time a piece of equipment arrives at the loading station until the shipping case is sealed, the work travels in a straight line on roller and belt conveyors and, with the exception of a little manual labor, is performed automatically. Bottom and top flaps are closed by an ingenious arrangement of air cylinders; glue is applied to all four outer flaps simultaneously; and sealing is done by a series of compression rolls. As compared with conventional methods, the system is said to save considerable floor space and work and to speed up packing. The accompanying pictures show the different operating steps and how they are carried out.





# K BIG ITEMS IN CARTONS



**1 NO HEAVY LIFTING.** The first step in packing large household and other equipment by the new sealing and closing system is to lower the carton over the merchandise so that the inner bottom flaps remain in a vertical plane and the outer ones in a horizontal position, as shown. In this case washing machines are being packed and arrive at the first station on a roller conveyor.

**2 PACKING STATION.** At this point the conveyor has two hinged sections that drop to accommodate the inner bottom flaps. They are power-operated and foot-controlled (see No. 1), as is the air cylinder which slides horizontal side plates in and out (shown partly retracted). The latter carry the load when the roller sections are down; they are retracted when the roller sections are raised to close the flaps and support the carton.

**3 SECOND STOP.** Here the worker places any necessary packing in the box, closes the inner top flaps and pushes the case onto power-driven belts that convey it through the sealing unit. Note

the plow-type bars that guide the outer top and bottom flaps to the glue rolls.

**4 HOW GLUE IS APPLIED.** As the carton travels through the gluing section it is held in alignment by side bars while the flaps are coated with adhesive in one pass through four sets of rolls, two of which are seen at the right. Closure of the flaps is effected by quick-

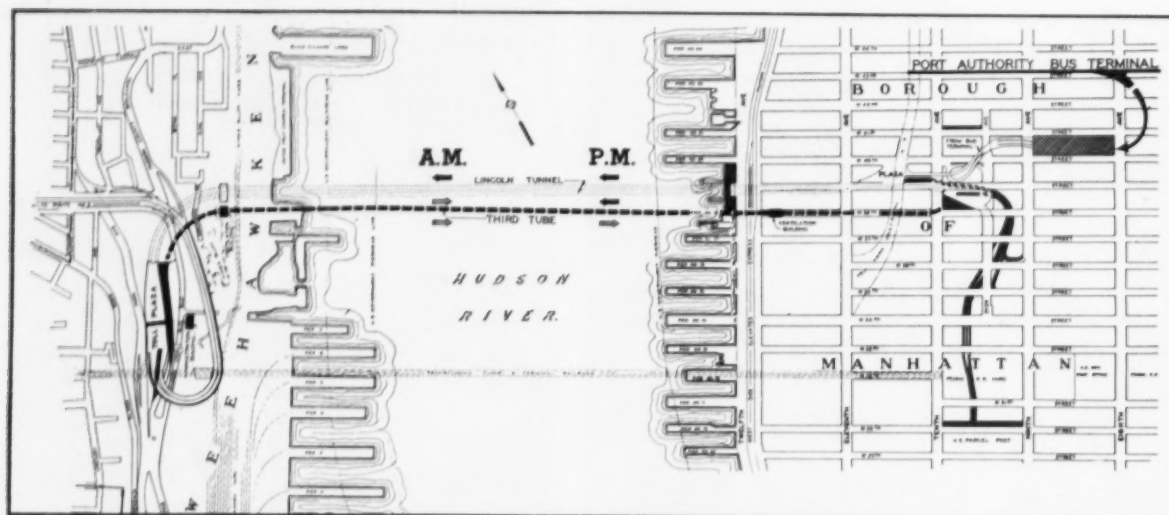
acting arms (not shown) that are actuated by air cylinders controlled by limit switches.

**5 FINAL OPERATION.** Before leaving the conveyor, the package goes through a squaring device that is also put into action by a limit switch. Here it is subjected to pressure applied by pendant rolls, a few of which are visible.

# LINCOLN TUNNEL THIRD TUBE

Hundred-million-dollar Passageway Under Hudson River Will Be One of the Most Expensive Stretches of Highway Ever Built

C. H. VIVIAN



## Part I

### TUBES AND CONNECTIONS

The third tube (above) is just south of the two existing ones and will share a common plaza with them in New Jersey. The plaza is being widened from 182 to 254 feet and five toll booths are being added to the thirteen now located there. Existing approaches are being widened to carry more traffic. At the New York end a new plaza is under construction, as well as an extensive system of subsurface approach and exit roadways. The latter will run eight blocks southward to 30th Street, which will be widened from three to eight lanes between 9th and 10th avenues. Conversion of 30th Street into a cross-town expressway is planned for the future. When opened next year, the new tunnel will provide additional capacity for 8½ million cars a year. All traffic in the north tube will always move from right to left; that in the south one from left to right. In the central tube it will normally be divided, but both lanes can be operated in the direction of peak travel during rush hours.

**S**ANDHOGS have recently completed burrowing and lining a hole underneath the Hudson River between New Jersey and New York for the \$100-million third tube of the Lincoln Tunnel. Their 1.04-mile subaqueous journey, which was started twenty months ago, was made by a succession of 32-inch steps, that being the distance the 240-ton shield, which spearheaded the advance, moved each time it was shoved ahead by the 28 hydraulic jacks at its rear end. After each step the



shield paused, while a segmented ring of iron or steel lining 32 inches wide was bolted together and to the ring back of it within the protective metal skin of its tail.

The mechanical mole began its trip in rock on the New Jersey shore, worked its way across the Hudson through the silt of the riverbed, passed on through earth fill deposited years ago on the New York waterfront and then entered rock again, this time a ledge extending out from the schistose backbone of Manhattan Island. Upon reaching the shaft over which the New York ventilation building had meanwhile been erected, it was hoisted and dismantled within the structure into pieces small enough

#### NEW JERSEY PERSPECTIVE

The topography necessitated this helical approach (below) from the higher ground back from the river. It is being changed little other than to widen it to handle more traffic. Beyond the broad plaza and line of toll booths in the left-center are the entrances to the three tubes, which make a sweeping curve of about 90° to the right after they dip underground. The three large square structures, top-center, are the ventilation buildings. Almost in the center of the picture is the new administration building. The old one stood in the way of construction.

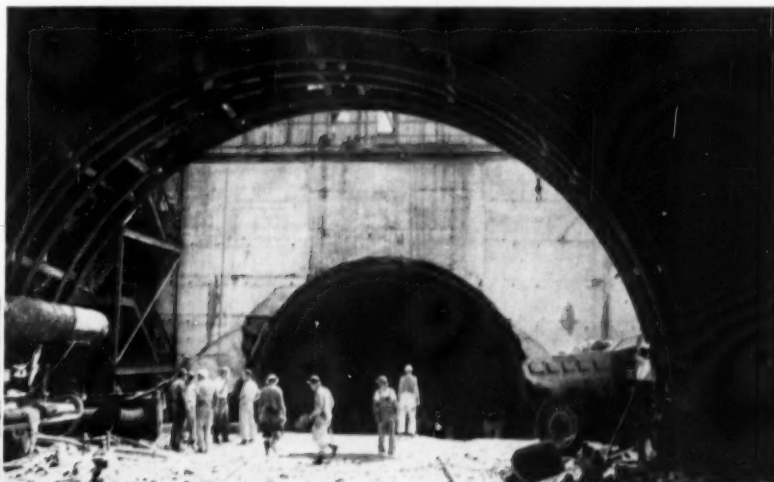


to be taken out and loaded for hauling away.

This underwater vehicular bore, which will be one of the most expensive pieces of highway ever built, virtually inched its way through the murky silt in order that future motorists may whisk through it safe and dry in a couple of minutes. Figuratively speaking, impatient drivers are already awaiting its opening, which will come sometime next year. In 1955 nearly twenty-one million vehicles passed through the two existing Lincoln tubes, and traffic regularly piles up at the portals during rush hours. The additional tunnel will increase the over-all capacity by 50 percent and the 1-way flow during peak-travel periods by 100 percent. With six lanes then available, three will normally be operated in one direction and

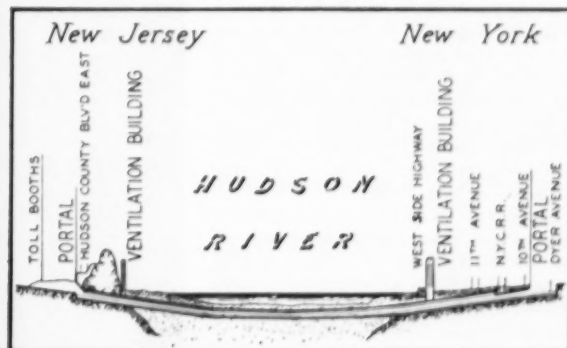
three in the opposite one. However, during the morning hours, when the greatest movement is toward New York, four lanes can be opened to it. This procedure can be reversed at night when most cars are going out of the city.

Like the existing tubes, the new one will be operated by The Port of New York Authority which is building it through a series of contracts. This joint agency of the states of New York and New Jersey was formed by compact on April 30, 1921, to direct future planning and development of the Port of New York. It was set forth then that "a better coordination of the terminal, transportation and other facilities of commerce in, about and through the port of New York, will result in great economies, benefiting the nation, as well as the



#### WHERE HOLE MEETS HOLE

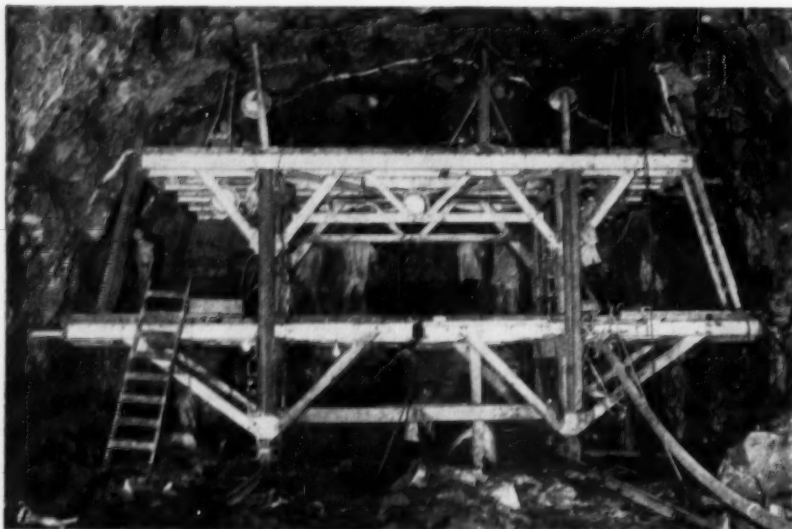
At Weehawken, looking eastward through the half-excavated King's Bluff tunnel portal across the construction shaft to the mouth of the section that plunges under the Hudson. It was here that the shield started its trip. At the right is a Koehring Dumptor loaded with tunnel muck awaiting transfer to a skip for hoisting and disposal.



#### LONGITUDINAL SECTION

The tunnel will be 7944 feet long between portals, with approximately one mile under the river. Maximum depth of the roadway below mean high water will be 97 feet. It will provide the fifth and sixth traffic lanes at this location. The first tube was opened in 1937 and the second one in 1945.





States of New York and New Jersey."

The metropolitan district embraced by the port area has a population of approximately fifteen million, which is about 9½ percent of the nation's total. It handles nearly 50 percent, by value, of the country's ocean-borne foreign commerce and 22 percent of its wholesale trade. It is the center of America's financial and industrial management functions. This "crossroads of the world" accounts for a greater volume of land, sea and air commerce than any other place on earth.

The Port Authority is directed by twelve unsalaried commissioners, six from each state, appointed for a 6-year term by the respective governors. Since its formation, it has expended well over half a billion dollars for structures to carry out its avowed purposes. It owns and operates seventeen terminal and transportation facilities. These, in addition to the Lincoln Tunnel, include the Holland Tunnel and the Outerbridge Crossing; Goethals, Bayonne and George Washington bridges; the Port Authority Grain Terminal, Port Newark and the Hoboken-Port Authority piers; LaGuardia, New York International, Newark and Teterboro airports; the Port Authority Building in New York; the New York and New Jersey Union Motor Truck Terminals and the Port Authority Bus Terminal in New York.

Autos, trucks and buses traveling between New York and New Jersey via the Authority's six crossings in 1955 totaled 85,600,000, of which the Lincoln Tunnel handled close to 25 percent. This was an increase of 3,900,000 vehicles or 4.8 percent over 1954. Autos were up 4.8 percent and trucks 6 percent, with bus traffic down slightly, this being a reflection of the trend towards larger buses and reduced schedules.

Pending completion of the third Lincoln tube the Port Authority has intro-







#### UNDER THE PALISADES

From the Weehawken shaft was driven 705 feet of tunnel 33 feet in diameter through King's Bluff to the toll-booth plaza. A top heading extending 4 feet below the center line was excavated first, as shown here. Eight Ingersoll-Rand Jackdrills, consisting of light Jackhammers mounted on hinged air legs, were operated from a 2-level platform. These easily maneuvered rigs, which weigh only 105 pounds, are pictured drilling at two different levels.

duced a new idea which, it hopes, will ease the crowded condition in the tunnels and also reduce the number of cars on New York's streets. It's remedy is a 10-acre, 1100-car parking lot constructed in the summer of 1955 a mile west of the New Jersey entrance to the tubes at a cost of \$500,000. Under an agreement with the Public Service Coordinated Transport Company, of Newark, a motorist traveling from New Jersey to New York may park his automobile there and be transported into the city and back to the lot by bus, all for one dollar. Additional passengers pay 27 cents each. This represents a considerable saving to the car owner, who pays 50 cents tunnel toll each way if he drives into the city, plus anywhere from 75 cents to \$2.75 for parking in New York.

Most of the parkers are commuters who use the tubes every working day during rush hours: 7 to 9 in the morning and 5 to 7 at night. Before the lot was ready for service, 4200 or more vehicles passed through the tunnel in the prevailing direction of travel during each of these 2-hour intervals. When motorists make full use of the "Park-Ride" facility, 25 percent of the peak-period tube capacity becomes available to re-

lieve traffic congestion. The parking area is open nineteen hours a day from Monday through Friday, twelve hours on Saturday, and closed on Sundays and holidays. Buses depart every five minutes during rush hours and every fifteen minutes at other times.

The third bore generally parallels the existing pair at a distance ranging from 130 to 190 feet south of the southernmost one. Of its total length of 7944 feet, 5486 feet was driven by the shield method, with the workings maintained under air pressure to prevent water from entering. This is the first of New York's many subaqueous tunnels to be advanced by a single shield, all the others having been driven by two shields working toward each other from opposite ends. The single-shield method is considered to be less costly and eliminates the difficulties that attend closing the gap when a pair of shields meet.

Another technique of constructing underwater tunnels, which has been followed in Detroit, Mich., Mobile, Ala., and other places and is now being used at Norfolk, Va., and Baltimore, Md., is to build the tube on land in segments, tow these into position above a trench excavated in the waterbed, sink and join them underwater with the aid of divers and finally pump the water out. It is claimed that this is a cheaper and less dangerous way of doing the job. However, it may at times obstruct shipping, which the shield method does not do. The Hudson River with its very thick silt bottom is declared by engineers to be particularly favorable to shield tunneling.

An undertaking of this type and magnitude is a rather complex and slow operation. It involves numerous kinds of construction other than the actual underwater burrowing. The shield's journey took something more than a year and a half, but it will require five years to finish the over-all work, which was started in 1952. Thus far more than 46 contracts, calling for an aggregate outlay of \$65,000,000, have been awarded. An indication of how costs have risen can be gained from the fact that the combined expenditures for the first tube, completed in 1937, and the second one, finished in 1945, were \$88 million, which is substantially less than the estimated outlay for the current crossing.

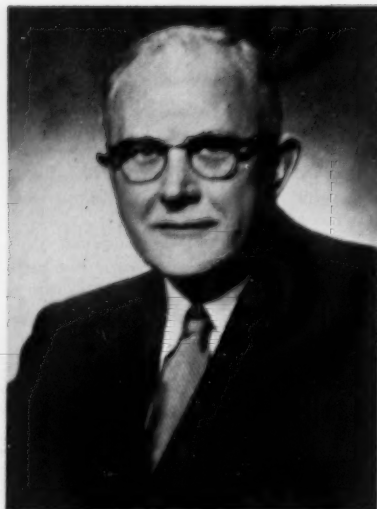
When the plans for the third bore were approved on March 8, 1951, the cost was computed to be around \$85 million but had to be increased before construction began. Of the revised total, a little less than \$43 million was allocated to driving and finishing the tunnel proper and the remainder among the various auxiliary operations. To provide room for an additional plaza and the network of new entrance and exit roadways needed at the built-up New York end, it was necessary to acquire and clear approximately \$10 million worth of property in the area

bounded by 30th and 41st streets and 9th and 10th avenues. These purchases, and the construction of the essential facilities, will amount to more than \$23 million. Property bought at the New Jersey end came to the more moderate but still sizable sum of \$2 million, to which will be added about \$9½ million for plaza and approach widening and other construction costs.

About 80 buildings were demolished in New York. These, aside from some business establishments, contained the apartments of 817 families, comprising about 5000 persons. The Port Authority undertook the task of finding new homes for those who requested it, and about 500 families did so. As most of them were renting at the rate of \$5 to \$7 per room monthly and didn't want to spend more, that was a difficult assignment. It was accomplished, however, without the necessity of making a single eviction. The Authority opened and staffed an office exclusively for the purpose, and paid real-estate brokers \$150 for each family they took care of. It also allowed each family \$100 for repainting and decorating its new quarters and \$100 moving expenses. The 317 that found new homes unaided received vacating bonuses up to \$200 each. The total cost of the mass relocation was \$240,000.

Although most of the actual river crossing was to be made through silt, the connecting links at both ends were to be carved out of rock. One of the first jobs was to sink shafts on each shore to the tunnel grade line, 85 feet deep in New York and 55 feet in New Jersey. Over these large (approximately 80x110-foot) rectangular openings have risen sizable buildings to house motor-driven fans and other ventilating equipment. In addition to serving this main purpose, the shafts provided points of attack for driving the tunnel. From the one in New Jersey the shield was started riverward, but first it was used by hard-rock men to gain access for advancing the landward section of the tube leading away from the river.

The shaft in Manhattan was excavated by Gull Contracting Company, Inc., of New York, which also has contracts for building the 1750-foot landward extension of the tunnel and connecting roadways that will be mentioned later. Another auxiliary operation on the New York side was the construction of a new \$1,500,000, 450-foot-long, 110-foot-wide marginal wharf between 38th and 40th streets to replace Pier 78, which had to be demolished because it was in the tube's way. The new wharf was built by Merritt-Chapman & Scott Corporation, of New York, and upon its completion in February 1955 removal of the old pier and supporting piling was begun by J. Rich Steers, of New York. The shaft on the New Jersey shore was sunk by Walsh-Perini-Connolly, which



#### PORT AUTHORITY LEADERS

The tube is a project of the Port of New York Authority, which has spent more than half a billion dollars to improve commercial and transportation facilities. It is governed by twelve commissioners, equally divided between the states of New Jersey and New York. They serve without pay. Donald V. Lowe (left) of Tenafly, N. J., was elected chairman of the group in 1955. He succeeded Howard S. Cullman (right) of New York who was elevated to the post of honorary chairman after ten years as chairman and 28 years as commissioner. Eugene F. Moran of New York is vice-president.

also constructed a steel-frame bridge across the New York Central Railroad tracks just east of the shaft site for use in disposing of excavated material during the early stages of the tunnel work.

The New Jersey shaft is at the foot of King's Bluff, the name given that section of the Palisades—a massive wall of rock with a core of intruded basalt that forms a rampart several hundred feet high and extends for a number of miles along the west bank of the Hudson. From the shaft the bore continues westward through the bluff and emerges upon a plaza. With the shaft dug, the way was prepared for driving in both directions, and bids were asked accordingly.

The successful bidder was Mason-Johnson-MacLean, a temporary joint-venture firm consisting of Mason & Hanger Company, Inc., Arthur A. Johnson Corporation and MacLean-Grove & Company, all of New York. The \$17,260,370 contract called for excavating and constructing 6160 feet of the 7944-foot tunnel, including 705 feet through the Palisades and the stretch under the river to the shaft on the New York side. The award was made in the fall of 1953 and the firm began work on November 9.

While the equipment needed for building the subaqueous section was being assembled the rock link at the western end was driven. In cross section this was a 34-foot diameter circle. The contractor chose to do the job in two stages, first advancing a top heading, 21 feet high and extending across the full width, and then taking up the remaining 13 feet at the bottom.

Most large-diameter tunnels in recent years have been driven with drifter drills mounted on either columns and arms or booms assembled on a carriage or "jumbo." A different technique was adopted

in this instance, the equipment consisting of Ingersoll-Rand Jackdrills. Each of these machines is made up of a JR-38 Jackhammer mounted on and supported by an air-powered telescopic leg. A complete unit weighs only 105 pounds and can be easily handled by one man. Eight of them were used in this case, and were operated from a 2-deck Mayo platform built at Lancaster, Pa.

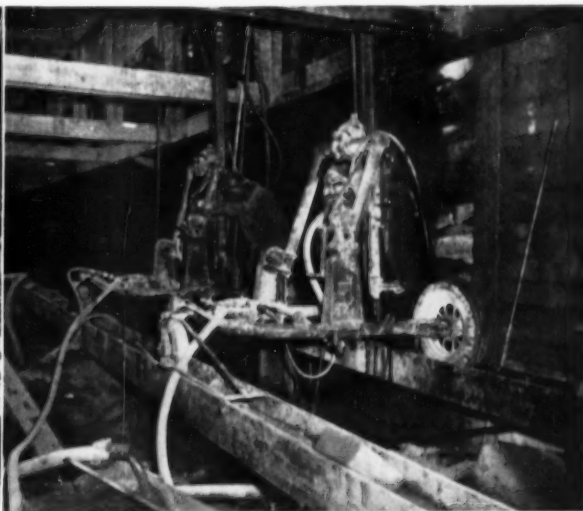
As an accompanying picture shows, the Jackdrills were not fixed or stationary—each was held in drilling position by its operator with the footpiece of the telescopic leg resting against a transverse strip of wood on one of the floors to keep it from slipping backward. The flexibility this method of handling makes possible is one of the advantages of the machine. It can be moved by one man in a few seconds, requires no setting up, and will drill holes at any height within its reach with hardly any physical effort on the part of the operator. Another advantage lies in the fact that the Jackdrill, using  $\frac{7}{8}$ -inch hexagonal alloy drill steel and  $1\frac{3}{8}$ -inch Carset (tungsten carbide-insert) Jackbits, bores smaller holes than a drifter. The small bits increase drilling speed and reduce both drilling costs and powder consumption. Another point in favor of these machines is their comparatively low air consumption.

Although the contractor was somewhat skeptical as to the wisdom of utilizing light drills in such a large-bore tunnel and looked upon their application as



#### CRAMPED QUARTERS

The New Jersey construction shaft from which the shield advanced is located at the left end of the bridge. The latter spans railroad tracks and was used to dispose of muck excavated from the rock tunnel through King's Bluff, in the background, as well as from the first few hundred feet of the tunnel driven towards the river at the right and in line with the bridge. The spoil was trammed across the overhead span in rail cars, dumped into the bin at the right and loaded into trucks through an air-operated gate. When the tunnel had been advanced beyond the near end of the bridge a small shaft was sunk in that area to intercept it. After that, most supplies and materials entered the tube through that accessway. Since this picture was taken the New Jersey ventilation building has been erected on top of the shaft. It matches the two in the background that serve the tubes previously driven.



### NEW YORK APPROACH ROADWAYS

Gull Contracting Company, Inc., is building the 1750-foot landward extension of the tube and most of the roadways leading from the plaza at 38th Street. As these pictures show, they are hewed out of solid rock by the cut-and-

cover method. Most of them are excavated 35 feet wide and in some places up to 75 feet deep. Both of these views show Ingersoll-Rand wagon drills putting down closely spaced line holes at one side of a cut.

an innovation, Jackhammers actually had been employed satisfactorily for a similar purpose more than 30 years before. In 1922, at Niagara Falls, N.Y., contractors Read and Coddington utilized Ingersoll-Rand BCR-430 drills and  $\frac{7}{8}$ -inch hexagonal steel in a 36-foot-diameter tunnel. First a top heading 18 feet high was driven full width. No drill carriage was used. Instead, 3-inch pipe columns, with horizontal arms extending from them, were set up. Two, three and even four machines were mounted on each column to which staging was also clamped to support the drill runners. The tunnel was advanced from four points, and ten drills were employed at each heading. The bench was later excavated with the same machines mounted on crossbars. Soon afterward the Armstrong Tunnel in Pittsburgh was driven in a similar manner by Booth & Flinn.

In the Weehawken bore either a 9- or a 12-foot round was drilled, and the number of holes ranged from 118 to 135, respectively. The first 200 feet of rock penetrated was shale, the next 250 feet was basalt and the final 200 feet was sandstone, the equipment working equally well in all. Only a faulted zone near the middle had to be supported. At some locations, where rock had a tendency to break and fall when being drilled, the full crew worked on the top level until that area of the face was completed and then moved below. Such adjustments to unusual conditions would not have been possible if drifters mounted in the conventional manner had been used.

A round of holes was loaded with 700 to 800 pounds (occasionally up to 900) of Du Pont 40-percent strength dynamite and fired electrically with up to

seventeen delays from the tunnel portal. Broken rock was loaded with a Bucyrus-Erie shovel with a shortened (14-foot) boom and dipper stick (12½-foot) and a heavy-duty 1-yard dipper. The lower level of the drill platform was opened in the center to permit the shovel to move up to the heading. An Eimco loader was used to clean up in the final stages of mucking.

Fauling was done by two 5¼-yard end-dump Koehring Dumpsters. At the portal the material was transferred to an 8-yard rock skip which was lifted out of the shaft by an American stiff-leg derrick and dumped into a hopper on the bridge. There cars were loaded from the hopper and pulled by a Whitcomb diesel-powered locomotive to the other end of the span where the muck was chuted into a truck on the ground below. For a time, spoil was transported to a low area on the nearby riverbank. Later, it had to be hauled from the site by truck. Working three shifts five days a week the crews advanced the heading from 18 to 24 feet a day.

The bench was removed by drilling vertical holes with two Ingersoll-Rand Wagonjacks using DB-30 drifters. Muck was handled as before. According to figures compiled by Crucible Steel Company, which furnished CA Double Diamond alloy steel for the drillrods, 108,500 linear feet of blastholes was drilled, and the average service life per rod was 630 feet.

This section of the tunnel was lined with bolted, segmental structural-steel rings consisting of 145 units each composed of ten segments. These were manufactured by Baldwin-Lima-Hamilton Corporation, and all of them were built

with a taper so as to give the bore a gradual longitudinal curve.

At the western end the tunnel connected with an open-cut excavation made by Grow Construction Company, Inc., of New York, which is also constructing the portal and widening the existing plaza from the portal to the toll booths, which will be increased in number from 13 to 18. Cayuga Construction Corporation is widening the remainder of the toll plaza and adding 20 feet to the width of the approach viaduct so as to provide two more lanes, bringing the total to eight. Foundations for the latter were built under an earlier contract by James Mitchell, Inc., which has also put up a new administration building near the plaza.

At the New York end the Gull Contracting Company, Inc., which has received contracts amounting to more than \$18 million, is constructing not only the 1750 feet of tunnel extending eastward from the shaft under 38th Street but also substantially all the approaches. To avoid adding to the congestion by pouring more traffic into the same channels that serve the two existing tubes, depressed 2-lane entrance and exit roadways are being carried southward between 9th and 10th avenues to 30th Street which, it is expected, will someday be a crosstown expressway. They are being excavated from rock by the cut-and-cover method and between 31st and 33rd streets will pass over the network of railroad tracks emerging from the Pennsylvania Station, a short distance eastward. Eight new bridges will carry cross-street traffic over the new roadways.

*(To be concluded)*



# COMPRESSED AIR AT WORK

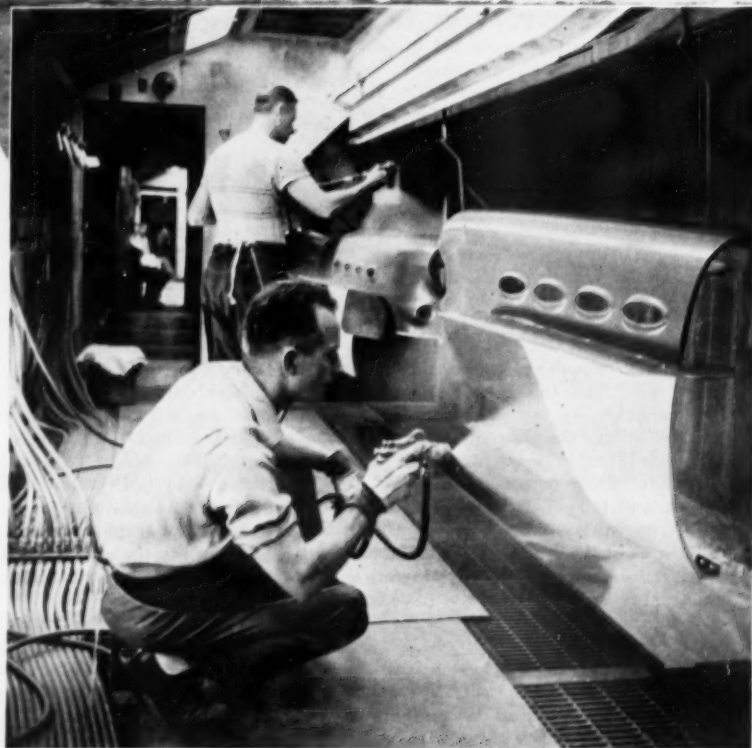
PHOTO, INCO NICKEL TOPICS



↑  
In an effort to eliminate erosion of airplane propellers that are exposed to salt-water spray, Hamilton Standard Division of United Aircraft Corporation and Bart Laboratories have developed a technique for applying heavy nickel plating to either aluminum or hollow-steel blades. The resistance of the coating is being tested in the set-up pictured by blasting the blades with sand and gravel, using air supplied by the Ingersoll-Rand portable compressor in the foreground.

●  
Two men working side by side with compressed-air guns spray different colors of paint on automobile fenders at the same time at the Buick factory in Flint, Mich. A metal shield 6 inches wide and as long as the fender is affixed temporarily, extending out at right angles and dividing it into two working zones. It prevents splashing and overlapping as the first man sprays the bottom part and the second one the top. Previously, it was necessary to send the fender through twice to obtain a 2-tone effect. →

PHOTO, AUTHENTICATED NEWS





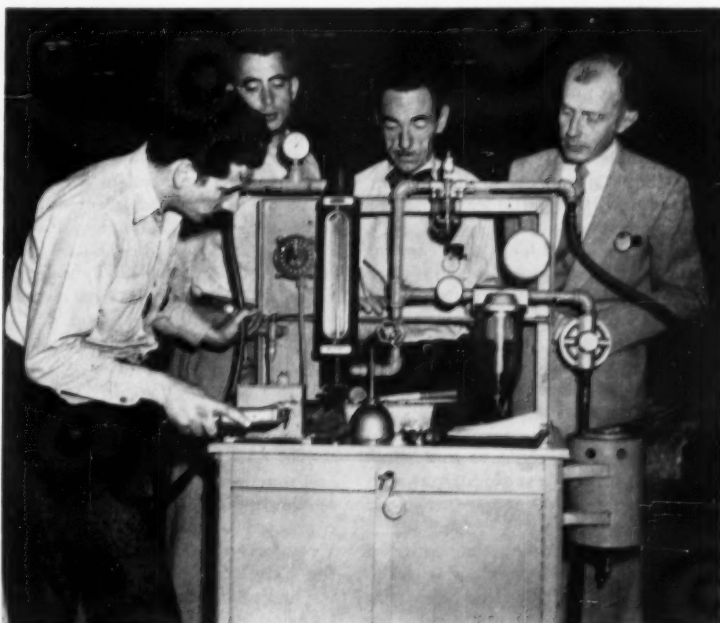
The Fyr-Fyter air mask pictured supplies the wearer with breathing air or oxygen from two tanks carried on his back where they don't restrict his movements. The equipment, which weighs only 35 pounds, is designed for use in smoky or gaseous atmospheres by firemen and rescue or industrial workers. Each cylinder holds 26 cubic feet of air or oxygen at 2600 psi pressure. A bell warns when the supply is low.



With the aid of this portable test cart, Ryan Aeronautical Company periodically checks the performance and lubrication of air motors and tools while they are in regular service. Those that need an overhaul get it right away instead of waiting until loss of efficiency is obvious, as was formerly done. This increases their productivity and prolongs their service life. Instruments on the cart include a tachometer, a flow meter, a filter and a test gauge.

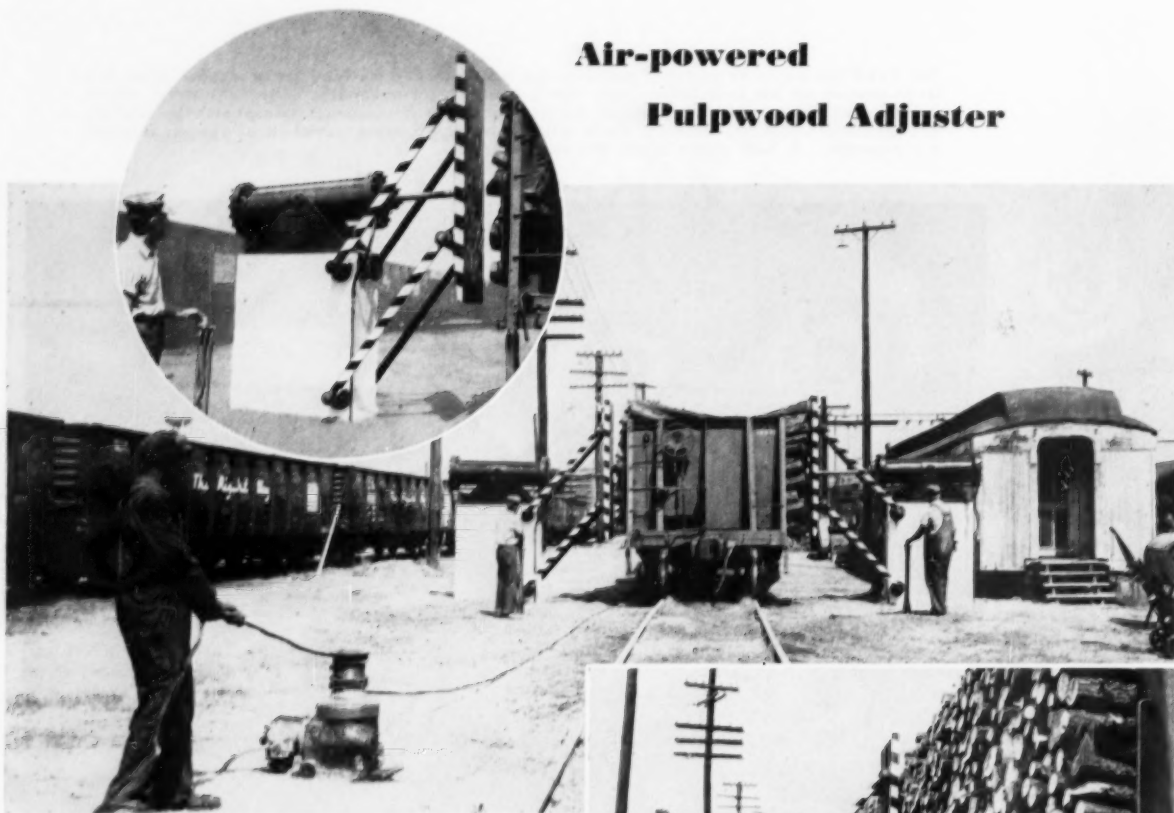


PHOTO, COMPRESSED AIR & GAS INSTITUTE



Engineers of The Glenn L. Martin Company have put to work the exhaust air of this pneumatic router, thereby eliminating two hand operations. Lubricant was formerly applied to the cutter with a paint brush, and the chips were blown away by means of a separate air hose. Martin engineers attached an air tube and an oil cup to the exhaust port. Now a regulated supply of oil is fed into the exhaust stream directed at the cutter head and both lubrication and chip removal are taken care of by the jet.

## Air-powered Pulpwood Adjuster



### AIR MUSCLES AT WORK

With operators at the controls on each side (center picture), pusher plates are extended to even up the ends of the logs. The man in the left foreground holding a rope wound around an air-powered capstan is ready to pull the car forward to bring another vertical section of the cargo between the plates. At the top is a close-up of one side of the device with an operator at his control station and the pusher plate extended. The view at the right shows details of the cylinder and pusher-plate assembly. The slanted paralleling bars extending from the concrete block to the plate serve to transfer to the foundation some of the force that would otherwise impose bending stresses on the piston rod.



**A** LOT of pine pulpwood is transported to the South's numerous pulp and paper mills. The Central of Georgia Railway hauls a great deal of it, using special cars with open sides and high retaining end pieces.

The wood, in 4-foot lengths of varying diameters, is loaded crosswise in two stacks. Jarring in transit occasionally causes shifting, and some of the pieces work outward until their ends extend beyond the safe clearance limit. Then it becomes necessary to realign them. Using lift trucks as battering rams, crews pound the offending sticks back into place. This is an expensive and time-consuming job, the cost running around \$25 per car, not including hard wear and tear on the equipment.

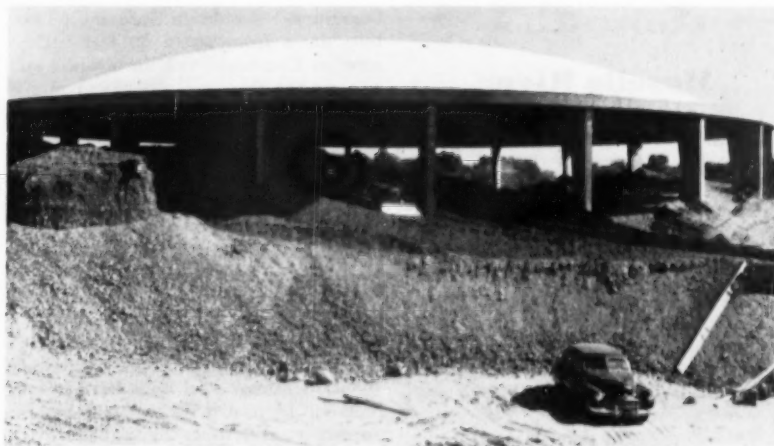
A better way of doing the work has now been developed. A device with opposed air-powered rams has been put in use that can tidy up cars of wood for

an average of \$2 each. Glen W. Burke, master mechanic of the Central of Georgia at Columbus, Ga., conceived the idea, and the mechanism was designed by W. H. Leavengood, mechanical engineer, and R. D. Thomas, draftsman. The Macon shops did the fabricating, even to building the air cylinders from 16-inch steel pipe. The first installation was made in Columbus and proved so successful that others followed at Macon and Albany, Ga. Application for a patent has been filed for the railway.

The machine consists of two identical double-acting air cylinders, each connected by a piston rod to a pusher plate and mounted on a concrete base. They are on opposite sides of the track and connected underneath it by means of a reinforced-concrete tie beam, making the complete assembly somewhat similar in design and operation to a giant C-clamp. With air at 90 psi pressure

applied to the cylinder rams, they can exert 18,000 pounds pressure across the faces of the plates, which are 7½ feet high and 3 feet wide. They can be operated in unison or separately and are controlled through 4-way air valves at stations on each side of the track. One man can operate both plates from one station, but as he can see only the wood on his side of the car two men are generally employed.

In practice, a car is spotted so that the plates are opposite the pulpwood at the end nearest the control stations. After the logs within the area covered by the plates have been pushed in and the plates retracted, the car is moved ahead approximately 3 feet by a rope wound around a capstan powered by a 5-hp air motor to bring another 3-foot vertical section of the load within range. The sequence is repeated until the entire load has been aligned.



#### CLEARING AWAY EARTHEN FORM

After the supporting concrete columns had been poured in excavations dug in the surface of the mound, the 220-foot-diameter domed roof was added. This shows the structure after bulldozers had removed part of the earth from underneath it.

## They Built It on a Mound of Earth

AMY PASSMORE HURT

**A**N AIR Force pilot, flying over Albuquerque, N. Mex., last winter, spotted something in one section of the city that looked like a sandhill with a tight-fitting cap. And that's just what it was. The "cap" is the largest thin-shell concrete dome in the United States and the roof of the new million dollar civic auditorium in New Mexico's metropolis.

The usual procedure in constructing a building of this type is to pour the dome on a mound of concrete, jack it up and then place the footings and columns beneath it. But in this case the supporting columns were poured in excavations dug on top of a hill. As the crest of the latter was about at the springing line of the dome, the architects and their structural engineering consultants decided to round it off to the desired contour, thus making an earthen mound on which to pour the roof. This method, obviously simple, had the added advantage of saving the cost of forms.

While the hills around Albuquerque are called sandhills, the soil of which they are composed has good bearing properties and no piling had to be driven to give the footings, which are wide, a firm foundation. The final step was to remove the earth that had supported the dome during its construction—to push it out from underneath into lower-lying areas of the civic-center site. This work involved the handling of some 88,000 cubic yards of dirt.

When the Albuquerque city fathers voted to undertake the project, they

decided that they wanted an auditorium with a seating capacity of 6000 and an arena—as opposed to a theater-type of structure where many different events could be held. In a large building of this kind it is important to get as many people as possible close to the center of activities, so architect Gordon Ferguson and his associates concluded that only a circular arena with a dome-shaped roof would do. Various methods of construction were studied. Finally, with the help of structural engineer Fred Fricke, of Albuquerque, and Carlos Bullock, an engineer employed by the Portland Cement Association, a concrete shell was agreed upon. It was not only practicable, they decided, but would be economical to build as well.

However, a dome of the size under consideration (220 feet in diameter) posed a serious problem. If treated as a plain reinforced-concrete structure it would undergo several inches of movement before settling and becoming stable, and it would also be subjected to severe stresses due to expansion and contraction. Therefore the architects and engineers came to the conclusion that the best method of preventing deformation through the cumulative forces exerted by the dome on the concrete ring or wall would be to post-tension the latter. That was done by wrapping an adequate number of high-tension cables around it.

Like most arenas, the floor is also of concrete, thus permitting it to be covered with earth or sawdust for circuses and rodeos and to have ice shows by flooding it with water and freezing it by means of refrigeration coils laid beneath it. Acoustical experts suggested a suspended ceiling of spherical or conical shape, thus making possible theater-type lighting, complete with catwalks. The distance from the floor to the top of the dome is 55 feet. The first tier seats 2500 people; the balconies 3500. An 8-foot-wide aisle behind the latter encircles the structure and leads to four lobby exits and to a mezzanine over the main glass-facaded lobby at the front. All told, with its various public rooms, the huge auditorium has something in excess of 70,000 square feet of floor space.

Egress from the arena is through two tunnels extending to the site's natural grade at the back of the building and up by way of two ramps to stairways leading to the front lobby. The balconies are served by two stairs ascending to the mezzanine and thence to exits on grades 22 feet above the rear arena exit and service court.

When completed, the civic center will, in addition to the auditorium, include a museum, a library, smaller lecture rooms and galleries and a huge parking space.



#### AS THE AREA WILL LOOK

Architect's rendering of the \$1,000,000 auditorium and adjacent structures planned for the Albuquerque civic center. Included will be a museum, library, lecture rooms, galleries and ample parking space.



**A** CENTURY old scheme for converting the Moselle River in western Europe into a transportation artery is about to be realized. Not only is the waterway to be canalized for 169 miles between Metz, France, and its confluence with the Rhine at Koblenz, Germany, but it is also to provide power for generating 750 million kilowatt-hours of electricity annually in ten powerhouses.

Two circumstances have prevented the project from being carried out previously. First, the stream flows through three countries: France, Luxembourg and Germany, and agreement and co-operation among the three always has been difficult to attain. Second, economic conditions and the technological status were unfavorable to its success until comparatively recently.

More than 100 years ago work was begun on improving navigation on the river between the French-German border and its junction with the Rhine. It was soon realized, however, that the stream was so shallow that only complete canalization would open it to large cargo boats and barges, and such an extensive project was then out of the question. Even as late as 1870 only low dams were considered feasible, and 40 of them were deemed necessary. Moreover, the possibility of using the Moselle's energy to develop power had not yet been foreseen.

As technological advances were made, the undertaking took on more favorable economic aspects, and in 1918 the Germans brought forward a plan to build twenty dams and enough hydroelectric plants to generate 400 million kw-hrs of electricity annually. However, they eventually shifted to a scheme to exploit the power potentials of two all-German waterways—the Main and the Neckar. Twenty years later they again decided to improve the Moselle from Koblenz to the French border, and after Luxembourg and Lorraine had been brought into the German economic orbit during the war it was proposed to extend the work as far as Thionville on the French side of the Luxembourg border. Some of the worst stretches were dredged and construction of a dam at Koblenz was started, but soon all activity ceased because of the demands of the war effort.

Following hostilities, France took the lead in urging her neighboring countries to join forces for consummation of the scheme, with Prime Minister and Foreign Minister Robert Schuman forcefully advocating it. The French financed a study of the technical aspects of the proposal and laid its results before the other nations concerned. Germany withheld support for some years, presumably at the urging of her steelmakers, but now has agreed to participate.

Present plans provide for a waterway

## Moselle River To Become Artery Of Transportation



### AREA TO BE AFFECTED

Dotted line shows the stretch of the river that is to be improved, and its relation to leading industrial cities.

with a minimum width of 162 feet and a minimum depth of 8 feet, all but five-eighths of a mile of it to follow the river's course. Of the total length, 19 miles will be in France, 28 miles in Luxem-

bourg and 122 miles in Germany. Thirteen dams from 20 to 30 feet high—nine in Germany, two in France and two on the frontiers of Luxembourg—are to be built, with locks measuring 550x39 feet for the passage of boats. Ten power stations—nine in Germany and the tenth on the line between Germany and Luxembourg—round out the program. The over-all cost is estimated at \$130 million, and completion is scheduled for 1962.

The waterway will provide a direct connection with the North Sea. France will have an outlet for Lorraine iron ore, which can be used to advantage by the German steel mills in the Ruhr Valley. In return, France will be able to import coal from the Ruhr and the United States (it is estimated that Lorraine steel mills will utilize at least 500,000 tons of American coking coal annually). The French industrial centers of Nancy, Metz and Thionville will, in effect, become seaports that will permit them to reach world markets by low-cost all-water routes.

Germany will reap the output of the power plants to help meet her current needs for electricity. Her Ruhr steel mills will be able to lower by 25 to 35 percent existing transportation rates on Lorraine low-grade iron ore known as minette, which is considered highly desirable for their Thomas blast furnaces. They are expected to consume approximately 3,000,000 tons yearly and foresee a reduction of from 70 cents to as much as \$1.80 per ton in the cost of producing pig iron.

Great economic expansion is looked for all along the course of the new waterway. Belgium and the Netherlands are expected to feel the effects of increased shipping in their ports, and it is believed that the benefits derived from the project will extend to all of western Europe.

## Air Under Pressure Unloads Bulk Sugar

**B**ULK sugar is being transported in Band discharged at the rate of 20 tons an hour, it is claimed, from a new type of trailer recently put in service by the Holly Sugar Corporation of San Mateo, Calif. Known as the Utility Trailer and built by the Industrial Tank Company, it is a pressure tank 40 feet long divided into three sections and makes hopper deliveries as required by means of Vacu-Veyor pneumatic equipment.

In the forward section of the tank is an engine, together with a positive-displacement blower driven by it; the sugar is loaded into the central one with three compartments; and in the rear section is installed a conventional-type dust collector. The entire system is completely enclosed.

At the point of delivery, the sugar is picked up by the air stream created by

the blower and carried through a stainless-steel flexible hose that is connected to the customer's receiving line. When the bulk material enters the storage bin, the air velocity is reduced and the sugar drops to the bottom by gravity. Any air-borne powder or fines that accumulate in the bin are deposited in the dust collector. All parts of the tank that are in contact with the sugar are either made of stainless steel or coated with plastic.

The trailer is one of two that are being used by the Holly Sugar Corporation and effecting considerable savings in unloading time. If the tonnage now carried by one tank were packed in bags weighing 100 pounds each, as is normally the case, it would take 4½ man-hours to unload them, a difference in favor of the new system of 3½ hours.



## Editorials

### MAKING SHIPS SAFER

THE recent tragic collision between two great ships has revived pleas that ocean liners be made unsinkable. It is possible to do this, but the initial cost would be high and, more important economically, it would cut down cargo space and make the loading of freight below decks more expensive. Consequently, there has always been a compromise between safety and practicality.

Curiously enough, the first transatlantic steamship ever built had what is today considered an important safety feature—a double bottom. That was the *Great Eastern*, once called the most discussed ship ever built—and the biggest failure. It was designed by Isambard K. Brunel, son of the inventor of the first underwater tunneling shield and himself in charge of the device during most of its initial 1200-foot passage through the mud of the Thames riverbed as spearhead for the 27-foot-diameter Rotherhithe-Wapping Tunnel.

From tunneling young Brunel turned to railroading and constructed for the Great Western Railway some 7-foot-gauge track on which trains were drawn by a locomotive having a steam engine that worked on the atmospheric-pressure principle. He convinced the officials that they should also engage in sea transport, and for that purpose built the *Great Britain*, 322 feet long, in 1839. Its hull was of iron, despite the prevailing prejudice of the British Navy against that type of construction. Furthermore, it was the first vessel with a screw propeller driven by a 2000-hp engine using steam at 5 psi pressure, and had a reserve sail area of six masts. After being stranded on the Irish coast soon after it went into service, it rode out winter gales safely and proved the soundness of iron construction.

Brunel next built the *Great Eastern*, which the company intended to use in trade with the East. It was a massive ship of 18,914 tons—length 692 feet, beam 82 feet, draft 30 feet. It was equipped with both propellers and paddle wheels, and sails were added because naval coaling stations were extremely scarce. The vessel had bad luck from the start. It struck bottom while being launched and couldn't be freed for six months. During that period its builders went broke. Eventually it was put in the Atlantic service, but was not suitable for it and was classed a failure. However, it did carry out the very constructive job of laying the transatlantic telegraph cable.

The double-bottom idea is a sound one, especially when combined with other hull-protecting measures. One that comes to mind was used effectively by

the British during World War II to save tankers that had been torpedoed. By keeping empty compartments under air pressure, many of them survived attacks and were able to reach repair bases.

Enlarging upon this idea, a naval architect, V. Yourkevitch, writing in the *New York Times*, recently offered a scheme for safeguarding liners against sinking after receiving hull wounds such as those suffered by the *Andrea Doria*. He would make the lower deck airtight and provide all openings in it with airtight covers. Then all the space below this deck, except the engine and boiler rooms, would be put under air pressure of approximately 15 psi. A ship so protected would, he contends, be able to keep water out even if damaged throughout a considerable part of its length.

### A PAYING PARTNER

CEREMONIES marking the completion of the U. S. Bureau of Reclamation's Colorado-Big Thompson Project were held in August at Loveland, Colo., situated in the heart of the 960-square-mile agricultural area that is receiving the benefits of the outstanding engineering-construction program. Begun in 1938, it is the largest undertaking so far carried to conclusion by the Bureau, though smaller than the Columbia Basin and Central Valley schemes that are still underway.

The Colorado-Big Thompson Project collects water on the western slope of the Rockies where snowfall is abundant, diverts it eastward through the range via the 13-mile Alva B. Adams Tunnel, sends it through several power plants during its 2000-foot drop to the plains and finally impounds it for distribution to farmlands. The latter have long been under cultivation but were not getting enough water to yield full crops. This feature of not reclaiming any previously untitled land makes the scheme unique in the Bureau's history.

During the two years that the system has been functioning, it has delivered 540,000 acre-feet of water (about 176 billion gallons) to the Northern Colorado Conservancy District it serves. At the Loveland celebration, Secretary of the Interior Fred A. Seaton stated that this water accounted for additional crops valued at \$41 million and added that "the cost of the project will be made up, many times over, in the gains you in this area will reap." Incidentally, the cost of the engineering works was \$160 million, and it is interesting to recall that this is 3.6 times the estimate of \$44 million made in 1938. The comparison shows that construction costs, interest charges, ad-

ministrative expenses, etc., have been greatly inflated in the interim.

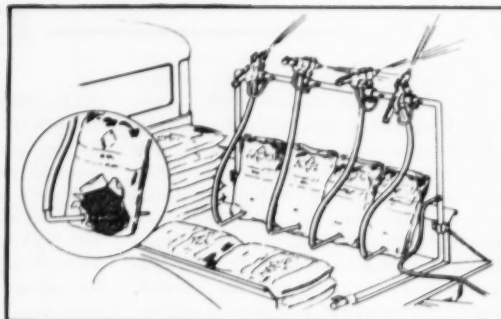
In his speech, Secretary Seaton made it plain that future Bureau projects will depend increasingly on revenues from their power aspects to repay their costs. There was a time when power wasn't mentioned in connection with its affairs, and the agency still calls providing water to make dry land productive its chief business. However, more and more irrigation schemes are including power-generation features, and the Secretary believes that "we must continue to look to power, even more in the future than in the past, as the paying partner of reclamation." It now plays that role in the Colorado-Big Thompson and Columbia Basin projects. He also thinks that the principle of "pooled power resources" should be applied to river-system improvement schemes that involve multiple undertakings. It is already in effect in the Missouri River Basin program and is envisioned as a part of the Colorado River Storage Project that was approved during the most recent session of Congress.

Perhaps the rising cost of planning and constructing reclamation works is somewhat responsible for this policy, especially in view of the fact that, as the Secretary points out, most of the easy-to-build projects have been carried out, leaving mainly large and expensive ones for the future. In answer to critics who think construction should be suspended while costs are so high and the money thus saved applied to reducing taxes, he states that less than half of the reclamation budget is supported by general tax funds and that the elimination of these expenditures would permit only a minute cut in taxes. Then, looking ahead to our potential 220 million population by 1975, he declares that it would cost us dearly in the end if we were to curb the reclamation program.

Secretary Seaton holds this to be so because we are taking about 1.6 million acres of land out of production annually and adding only about 100,000 acres through reclamation—a ratio of 16 to 1. He predicts that the time is rapidly approaching when the nation will be more concerned about how soon water and fertility can be brought to unproductive acreage than it will with crop surpluses. He also makes the point that only a small part of price-supported crops are grown on irrigated lands and that most of them are fed locally to livestock. On the other hand, the country derives 85 percent of its winter vegetables as well as vast quantities of fruits and nuts from western irrigated lands. The leading crop in the area under the Colorado-Big Thompson Project is sugar beets.

### MULTIPLE-GUN MOUNTING

The tubular frame on which the guns are mounted also carries operating air to them. Mountings are available for either two or four units. The circled drawing shows how the feeder nozzle is thrust through the bottom of a sack. A hopper of any desired capacity can be obtained for spraying bulk material.



## Air Gun Broadcasts Fertilizer and Seeds

**A**N AIR-operated "gun" that sprays granular fertilizer, limestone or pelleted seeds for distances up to 75 feet is being produced by Chowning Regulator Corporation, of Corning, N. Y. Called Ferti-Blast, it operates on the same principle as the familiar sandblast gun, but has some distinctive features. For example, it is designed to broadcast materials directly from the bags in which they are received and accomplishes this by means of a pointed, nozzle-like feeder

that is thrust through and out of the bag near the bottom. The feeder has openings through which the granules enter, and they are then delivered to the gun through a connecting 1-inch hose, the top of the bag being open to permit air to flow freely.

A second hose, of 1/2-inch size, conveys air from a portable compressor to the spray unit, the air flowing into it back of or upstream from the point where the solid material enters. It passes

through a special stainless-steel jet and on out of the blast nozzle, picking up the granules and creating the suction that draws them from the bag into the gun.

Two guns are normally operated at a time, working from a pick-up truck which carries sacks of the material being sprayed and also tows a portable compressor of 125-cfm capacity. This machine is big enough to keep the pressure up to the desired 100-psi level. If the pressure drops below 80 psi, the output of the guns and their range will be reduced. The latter may be hand-held and directed or mounted on a tubular frame having stations for two or four units. If four are utilized, a larger compressor is provided.

Because of its wide coverage, the Ferti-Blast method is effective for fertilizing or seeding sloping surfaces of high cuts on highways. Trees or shrubs do not interfere with its action, and it will reach places on golf courses and in parks that are inaccessible by hydraulic or other conventional means. It is claimed, also, that it can be used successfully in windy weather.

Field tests conducted by the highway departments of New York, New Jersey and Maryland indicate that fertilizer can be applied approximately twice as fast by Ferti-Blast as with hydraulic applicators. Two guns can spread the material over the surface of a high bank at the rate of about 25 pounds per gun per minute and cover a 10-acre flat area in less than an hour.



### SPRAYING ROADSIDE SLOPE

Two Ferti-Blast guns in operation in a cut on New York State Highway 17. More than eight acres of steep bank were covered with granular fertilizer in less than 45 minutes. Material can be deposited 75 feet up the slope under average conditions.

## This and That

### Air Drill Promises Less Pain

Among new dental equipment and accessories shown to 600 Scandinavian dentists at Stockholm, Sweden, in July was a high-speed pneumatic drill for boring and polishing. It is stated that the tool, which is not yet on the market, will turn at a speed of 40,000 to 50,000 rpm, or about eight times as fast as drills now in service. This, reportedly, makes the vibrations less perceptible to the patient and thus lessens

his discomfort. The announcement is of additional interest because some authorities claim that the first pneumatic tool invented was for dental use. It was a small reciprocating hammer called a plugger, introduced in England in the early 1870's for tamping gold fillings in teeth. The Scandinavians profess to be leaders in the field of dentistry and especially in making natural-looking false teeth, which they export to many lands, including 100,000 sets a year to the United States.

### Biggest Since Suez

What has been called the biggest earth-moving job undertaken in the Near East since the construction of the Suez Canal is a recently completed project on the Tigris River in Iraq. It is designed to stabilize the flow of the stream and thus put an end to alternate flooding and parching, both of which seriously interfere with farming operations. The scheme consists of a dam and a canal to divert the surplus water to a natural

depression or wadi where it will be stored and then drawn upon later for irrigation. The basin is about 25 miles wide and 62 miles long. Most of the 52 million cubic yards of earth moved was excavated from the 3½-mile canal, which is 516 feet wide and 54 feet deep.

★ ★ ★

**They Mine Type** A couple of San Francisco men have found an unusual sort of metallic wealth in early California mining towns. They maintain a typographic service, specializing in setting up advertisements, and the treasure they have dug up is neither gold nor silver but base metal in the form of old type. All the early mining camps published newspapers and had job printing shops, and some of them were just closed up when mining operations petered out and the population thinned down. By searching out these old establishments, the typographers—Richard Reardon and Theodore Krebs—have built up a stock of obsolete type faces that are much in demand for special purposes. As a result, the firm gets business from all over the United States.

★ ★ ★

**Pneumatic Snow Shovel** The British Transport Commission turned to compressed air last winter at York to cope with unusually heavy snowfalls that threatened to disrupt passenger railway service. In an effort to keep switch points and crossings clear, flame guns were first tried. They melted the snow, but too slowly to be effective. Steam lances were next tested but had to be accompanied by a locomotive to furnish the steam, and the latter also

created a fog that hid the men and exposed them to the danger of being struck by trains.

Realizing that compressed air could be drawn from lines serving electropneumatic switches on 37 miles of track and sixteen platforms, A. F. Wigram, signal engineer, decided to experiment. When a hose equipped with a long nozzle and valve was connected with the air main it was found that the blast, under 70 psi pressure, would clear away snow for a distance of 10 yards, and it also had the effect of vaporizing it so that much of it disappeared.

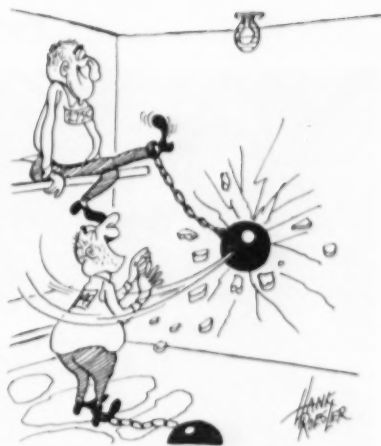
Eventually seventeen nozzles were put in use to cover the whole York station area in which there are 157 sets of switch points. Although 169 trains pass through it daily, the tracks were kept reasonably clear. On the morning of February 14, more than 8 inches of snow fell in York and the temperature dropped to 11° below freezing, yet trains ran only a few minutes late.

★ ★ ★

**Controls "Fizz" in Drinks** When a coin is dropped in a machine that dispenses soft drinks, measured quantities of flavoring syrup and water are combined,

charged with carbon-dioxide gas and delivered to the customer in a paper cup. Heretofore it has been impossible to serve uniform beverages because the absorption of carbon dioxide varies with the temperature. If the dispenser is in a warm place, the drink will hold so little gas that it will be "flat." Conversely, if the location is a cold one an excess of gas will be absorbed and the drink will be too foamy.

Now, thanks to a new type of bellows-actuated valve developed by Minneapolis-Honeywell Regulator Company, the



"I didn't swing a wrecking ball ten years for nothing."

degree of carbonization will be the same regardless of conditions. The device operates throughout a range of 40 to 130°F and can be adjusted to deliver gas at 25 to 111 psi. It is mounted on the line between the carbon-dioxide cylinder and the tank containing the premixed liquid, and will regulate the flow of gas according to the temperature. Where more than one kind of beverage is dispensed by a machine a valve will be provided for each one.

★ ★ ★

**Frozen Foods in Sweden**

The frozen-food industry has made great progress in Sweden and differs in some respects from ours. As many housewives there work outside their homes, frozen foods are especially welcome because of the time they save in preparing meals. Home freezers are common, and instruction in all phases of food processing is available through motion pictures, lectures, pamphlets and cooking classes.

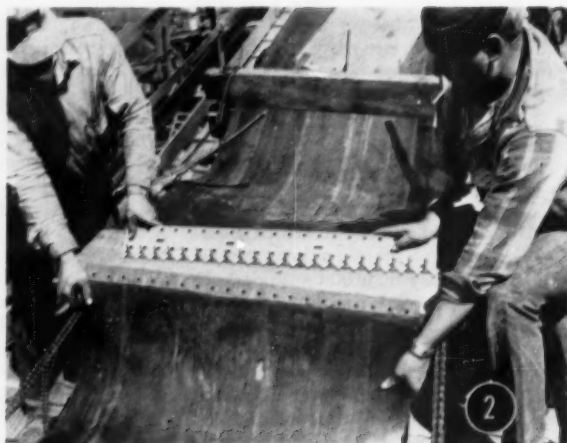
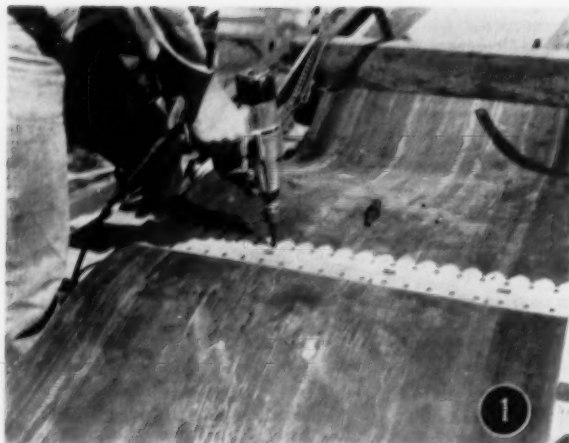
Frozen foods are also widely used in hospitals, public institutions and restaurants. More than 400 varieties can be bought in grocery stores, but so far few of them are ready-cooked because the women prefer to season and cook their own dishes. Fish filets are popular, and one large manufacturer has aroused interest in them among children by offering, as a publicity stunt, to buy back any bones found in the product.

The processors have much of their equipment on railway cars, which move from place to place. In the spring they freeze fish along the coasts, in summer they handle berries and vegetables in the central provinces and in the autumn they take a trip to Lapland to process reindeer meat and delicious cloudbberries. Thanks to refrigerated ships, the two last-mentioned delicacies are now available to transplanted Swedes in America.





## Power Tool Speeds Belt Repair



**T**HE conveyor-belt splicing method illustrated here is said to cut in half the time usually spent in applying fasteners. A special boring bit and wrench designed to fit standard chucks of either air or electric Impacttools are utilized, as well as a template for spotting holes and inserting fasteners. Known as the Flexco Belt Fasteners, the new splice is a product of the Flexible Steel Lacing Company. In Picture No. 1 the repairman is boring holes in a belt with an Ingersoll-Rand 5U electric Impacttool furnished with a Flexco bit. No. 2 shows the template being used to align and insert the fasteners, and in No. 3 nuts are being run by one man while another trims the fasteners flush with the belt by means of bolt breakers. The manufacturer claims that a 30-inch belt can be repaired in this way by a 2-man team in about 15 to 20 minutes.

*Circle 1E on reply card*

## Automatic Rivet-Placing Device

**A**N INGENIOUS air-powered machine has speeded a subassembly operation at Delco Remy Division of General Motors Corporation by automatically placing and press-fitting twelve rivets at a time in a thin slab of insulating material. The fasteners are not peened but are left protruding for the addition of various parts and are then set. The complete assembly is a junction box for electrical components on an automobile.

The rivets are dumped into an oscillating hopper with twelve feeder chutes in the bottom—slots wide enough to accept the shanks but too narrow to pass the heads. Thus the rivets, with their heads up, are fed to a sliding escapement actuated by a 1-inch pneumatic cylinder. The insulation is held by pins on an indexing table and, as the latter rotates, a hinged rivet-positioning fixture is overbalanced by a cam and falls on each slab. At this point one rivet from each delivery chute is released by the escapement and drops through a plastic tube into a block—a manifold-like arrangement—with holes corresponding to those in the fixture and the insulating material. The block

is lowered by a 2-inch air cylinder, and all twelve rivets fall into place simultaneously.



### WORTH MANY FINGERS

Twelve rivets at a time are fed from the hopper of this machine through plastic tubes to a block above and at the rear of the indexing table and are then force-fitted into a  $2\frac{1}{4} \times 2\frac{3}{4} \times \frac{1}{4}$ -inch slab of insulating material which forms the base of an electrical junction box for automobiles. Four air cylinders do most of the work. By changing the block and the hinged fixtures, most of which are shown in the up position, the machine can dispense and place as many as eighteen rivets.

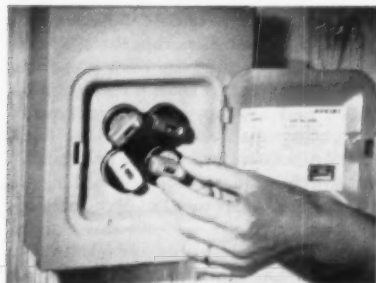
At the work station a pneumatic die punch pushes them into the force-fit holes in the slab. As the table continues its cycle, the positioning fixture is lifted and a pop-up ejector frees the insulating plate from the pins for easy removal by the operator. The rotary table also is powered by compressed air—a 4-inch cylinder indexing it by actuating a shot-pin mechanism.

Metallurgists at the University of Michigan have reportedly produced an alloy based on nickel that is said to have nearly 40 percent more tensile strength than cobalt-based metals and from two to ten times their ductility. By the process under development there the alloy is fused in a high vacuum and the melt poured in an atmosphere of argon gas to prevent contamination from oxygen, nitrogen and hydrogen. The material would cost about half as much as cobalt alloys, according to Richard A. Flinn, professor of metallurgical and production engineering at the university, and would not only increase the service life of jet engines but also bring us closer to the day of gas turbine-driven automobiles.



## Industrial Notes

No more dangerous groping around to locate and replace a blown-out fuse in a crowded box. That is the claim made by A. Lawrence Karp who has announced the Sightmaster, a fuse that glows when it blows. Each has its own tiny neon beacon that leads you straight to it, and it does not have to be removed



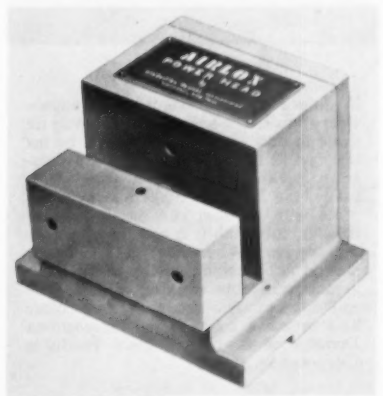
until its six lives have been spent. About an inch long, it is automatically renewed by turning a safety dial to the next position. The fuse is made in 15, 20, 25 and 30 amperes distinguishable by different colors in order to prevent hazardous interchanging.

Circle 2E on reply card

Heat-resistant tannate leather packing for hydraulic and pneumatic applications is said to provide an effective seal against gases and liquids such as hydraulic oils. The material is impregnated to order for different pressures and molded to fit accurately against shafts and cylinder walls. A product of J. E. Rhoads & Sons, it is designed for use under difficult operating conditions.

Circle 3E on reply card

To its line of Airlox pneumatic equipment, Production Devices Incorporated has added a Power-Head that had its first showing at the 1956 ASTE Industrial Exposition in Chicago, Ill. Of simple lines, it is designed to operate fixtures on machine tools and on welding, assembly and other jobs where a force



of 1200 pounds or less on the work surfaces. The head has a guided, movable jaw with a 1-inch stroke and spring return and exerts a push  $12\frac{1}{2}$  times greater than the applied air-line pressure. The device can be used singly or in series, horizontally or vertically and is available with manual or automatic control.

Circle 4E on reply card

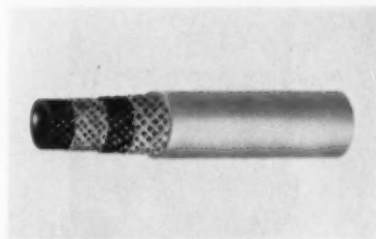
In addition to its heavy-duty, air-operated torque-control Impactool, which was described in detail in the February 1956 issue of this magazine, Ingersoll-Rand Company has designed and put in production an electric tool of the same type. The Size 5UT, as it is designated, is equipped with one of two detachable torsion bars that can be easily set to any desired torque from 20 to 90 foot-pounds by twisting the bar and locking it in place with a calibrated torque locking sleeve. Setting may be for either right- or left-hand torque and remains constant for any nut-running operation until it is changed.



The tool is reversible, with full power being delivered in both directions, and shuts off automatically when the preset torque is reached. It is expected to have wide application in the building and construction industry, in assembling metal parts or wherever nuts, bolts, studs or screws have to be run to precise torque. If that is not necessary, the selector that controls the shut-off device is turned to the off position, permitting the 5UT to be used as a conventional Impactool. With standard accessories it can also be utilized to drill metal, masonry or wood; to ream, tap or drive screws; and to do wire brushing or hole sawing within its rated capacity. The new torque-control Impactool has an over-all length of  $10\frac{1}{4}$  inches, exclusive of the torsion bar, weighs  $6\frac{1}{2}$  pounds and delivers 1900 impacts per minute. It runs bolts up to  $\frac{5}{8}$  inch in diameter.

Circle 5E on reply card

Duraprene is the trade name of a new lightweight air hose offered by Acme Rubber Mfg. Co. A general utility hose, it has a tough red cover and black tube, both oil resistant, and is reinforced with two plies of high-tensile, braided rayon



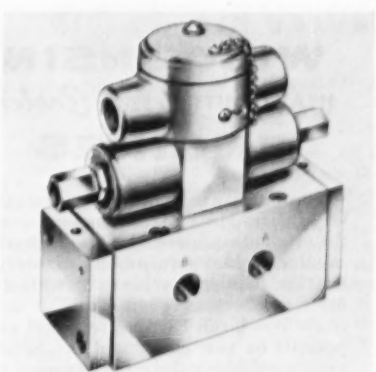
cord. It is available in  $\frac{1}{4}$ ,  $\frac{5}{16}$  and  $\frac{3}{8}$  inch inside diameters for 200 psi working pressure and  $\frac{1}{2}$ ,  $\frac{5}{8}$  and  $\frac{3}{4}$  inch for 150 psi. Minimum length supplied is 50 feet.

Circle 6E on reply card

Accidental dropping of crane booms is prevented, it is claimed, by a safety device invented by a man who has operated cranes for 30 years. It can be installed in less than an hour and controls the unwinding of the boom cable from its drum by coupling the drum movement to the crane engine.

Circle 7E on reply card

For controlling pneumatic cylinders and other air-powered devices, Hanna Engineering Works has introduced a new series of solenoid and master valves for 3- and 4-way operation. Called the Flo-Line, it is designed so that internal passages are full valve-port size, it is dust-tight and splashproof, has few moving parts and is made of aluminum, brass and stainless steel for long-lasting performance. Easily replaceable "O" rings protect the valve spool against leakage, and a built-in junction box facilitates making electrical connections. The main



valve body is suitable for pressures from 0 to 250 psi; the pilot valve from 20 to 150 psi. The Flo-Line is available in five sizes from  $\frac{1}{4}$  inch through 1 inch.

Circle 8E on reply card

Hagan Corporation has announced a pneumatic pressure-ratio computer that measures compressor inlet and outlet



pressures and simultaneously calculates the ratio of the two factors. Pressure ratio is a key variable that must be regulated to prevent flow instability or surge in exhauster, compressor, blower and other control systems. The instrument, Model PR-O, indicates the result on an integral scale and generates a pneumatic signal proportional to it. It is available for application in static-pressure ranges from 0-10 psia up to 0-400 psig and higher. Calculating accuracy is said to be high even when the input static-pressure turndown ranges are as great as 30 to 1.

Circle 9E on reply card

To supply cooling water for diesel and other engines, small industrial plants and even air-conditioning systems in areas

where water is scarce, Badger Mfg. Co., has announced a cooling tower on wheels complete with pumps, strainers, fans, electrical control devices and water-treatment equipment.

Circle 10E on reply card

Fiberglass low-pressure pipe insulation for cold, hot-water and steam lines has been put on the market by Owens-Corning Fiberglas Corporation. The new product has a 1/2-inch-thick layer of fine-fibred insulation jacketed by heavy, creped Kraft paper laminated to aluminum foil which serves as a vapor barrier. The outer surface is off-white in color and presents a pleasing appearance, but



may be painted. The material is designed for a temperature range of 50-250°F and is available in 36-inch lengths and diameters from 1/4 inch through 12

inches for iron pipes and 1/2 inch through 4 1/8 inches for copper tubing. Metal bands, stapling and similar methods should be used to install it on hot lines; a suitable adhesive on cold ones.

Circle 11E on reply card

Two tiny TV cameras have recently been produced for industrial purposes. One, 2 inches in diameter and 6 inches long is of German manufacture and serves to locate faults in boiler tubes. It has springy rollers and is drawn through a tube by a perlon thread. Compressed air is used to blow the latter through tubes less than 3 inches in diameter and 2 inches in radius curvature. The other one was developed by Lockheed Aircraft Corporation and is used to watch airplane components during testing. It measures 2x1 3/4x5 inches.

Reinforced glass fiber-and-plastic windows that let in as much as 50 percent daylight are being made by Firestone Tire & Rubber Company to protect stored materials such as rubber from harmful ultraviolet rays. The panes can be provided in any color and are said to be well-nigh unbreakable.

Circle 12E on reply card

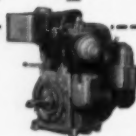
What is believed to be the softest non-porous rubber available is being produced by Roth Rubber Company, 1860 South 54th Avenue, Chicago 50, Ill. Marketed as Compound RRD-992, it can be used to dampen sound in as small an item as an electronic hearing aid, to absorb vibration, and as an air- or water-tight gasket material. It can also be

## POWER to Match Your Equipment

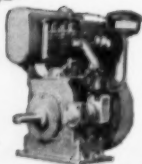
### WISCONSIN HEAVY-DUTY *Air-Cooled* ENGINES

• The extreme compactness and relatively light weight of these engines enable the original equipment builder to develop smaller, lighter equipment to replace heavier, bulkier machines powered by more cumbersome engines . . . or to include Wisconsin Engines as power components on new equipment . . . without sacrificing heavy-duty performance and dependability. Thirteen models, (3 to 36 hp.) offer power selectivity to match your equipment.

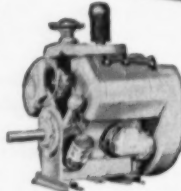
Tell us about your power problem. Detailed "Specs" and engineering data gladly supplied.



3 to 6.8 hp.



6 to 9 hp.



15 to 36 hp.



7 to 15 hp.



### WISCONSIN MOTOR CORPORATION

World's Largest Builders of Heavy-Duty Air-Cooled Engines  
MILWAUKEE 46, WISCONSIN



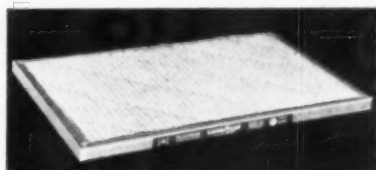
#### IT FOLDS AWAY

If you are an executive or have a supervisory job that necessitates drawing or drafting now and then you might be interested in the neat desk and drawing-board arrangement shown here. Normally, the board is tucked away complete with parallel rule in the center drawer, to which it is attached by special hinges. When needed, it is easily moved into position on top of the desk at a comfortable working angle. The unit comes in two sizes and three colors and is made by the Arnot-Jamestown Division of the Aetna Steel Products Corporation.

Circle 13E on reply card

bonded or molded to metal and other materials to meet customers' needs. The rubber is said to have a softness characteristic of 5 durometer, to be resistant to temperatures up to 200°F and to be a reasonably good electrical insulator. It is made in sheets or strips up to 1 inch thick. Free samples are obtainable.

Highly sensitive "electronic brains" called GEDA (Goodyear Electronic Differential Analyzer) are protected from microscopic atmospheric dust by self-charging electrostatic air cleaners also invented and made by Goodyear Tire & Rubber Company. The filter consists of a metal holder containing Pliotron, a shredded polyethylene plastic material. When the latter is exposed to the flow of a dust-laden air stream it generates an electrostatic charge which, in turn, captures and holds dust, smoke and even pollen. As the energy used by electronic brains creates a great deal of heat that



must be dissipated by exhaust fans, the new cleaners are placed in grids between the source of the outside air and the analyzer to safeguard it from the ravages of foreign matter. They can be cleaned with warm water as the static charge, with the dust, runs off in the water.

Circle 14E on reply card

High pressure-high velocity flows can now be measured and transmitted pneumatically on a linear flow basis, it is claimed, by a new line of high-head differential pressure transmitters announced



by Bailey Meter Company. Taking advantage of the accuracy of mercury U-tube measurements, the instruments meter the rate of flow of steam, water, other liquids and gases producing maximum differentials from 100 to 1200 inches of water under service pressures from 800 to 6000 psig. Where the use of a mercury U-tube is undesirable a bellows type is available for pressures of 1500-3500 psig. Signals are SAMA standard, 3-15 or 3-27 psig, and may be transmitted to indicating, recording and/or integrating equipment. As measurements are linear with flow rate they may be combined with other related factors on an evenly graduated chart.

Circle 15E on reply card

Using the same balanced-pressure principle as in its 6000 psi Lo-torq selector valve, Republic Manufacturing Company has introduced a new line in the 0-1000 psi range—0 to 500 psi for air or gases; 0 to 1000 psi for liquids. Operating temperatures vary from -65 to 160°F. Two dynamically loaded



"Well, it looks like we have another general manager with a lousy aim."

Two Sure Ways  
to Prevent  
Air Loss



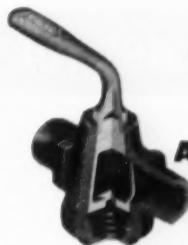
"AIR KING"

Quick-Acting  
HOSE COUPLINGS



For All Hose Connections

These plain rugged couplings are your surest safeguard against loss of air at the hose connections. Universal locking heads, on sizes up to 1", snap together to form a secure lock that is leak-proof under pressure; in fact, pressure must be released before coupling can be disconnected. Ideal for rough outdoor work as well as indoor shop and plant service. Malleable iron, cadmium plated, and bronze. Hose Ends, Male and Female (P.T. Ends. Size range, 1/4" to 1". Also available in 4-lug type, not universal, in 1/4" to 2" sizes.



"BOSS"  
Self-Honing  
AIR VALVES

For the Entire  
System

The most efficient and economical valves for all valve stations on the system—automatically, permanently leakproof—no packing to wear out and replace—straight-line, full-flow opening through body and plug. Self-adjusting bronze plug automatically hones itself against harder steel or malleable iron valve body, maintaining a perfect leakproof seat. Proper spring tension assures constant sealing adjustment. Strong, durable construction, with handle attached to plug within the valve body. Male or female thread both ends, in sizes 1/4" to 1 1/2".

Stocked by Manufacturers and Distributors  
of Industrial Rubber Products

**DIXON**  
Valve & Coupling Co.

GENERAL OFFICES & FACTORY—PHILADELPHIA 22, PA.  
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DIXON VALVE & COUPLING CO., LTD., TORONTO Associate Companies  
Dix Valve Company, Inc., Garyville, Pa. - Precision Brass Steel Company, Camden, N.J.

Circle 19A on reply card

(283)

Adv. 20



# VICTAULIC®

## METHOD OF PIPING

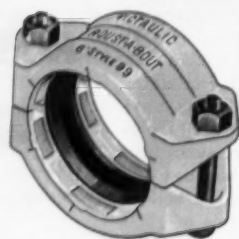


**VICTAULIC HAS EVERYTHING...**



### VICTAULIC COUPLINGS

Simple, fast, reliable. Styles 77, 77-D, for standard uses with steel or spiral pipe, — Style 75 for light duty. Other styles for cast iron, plastic and other pipes. Sizes  $\frac{3}{4}$ " to 60".



### ROUST-A-BOUT COUPLINGS

For plain or beveled end pipe Style 99. Simple, quick, and strong. Best engineered and most useful plain end coupling made — takes a real "bull-dog" grip on the pipe. Sizes 2" to 8".



### VICTAULIC SNAP-JOINTS

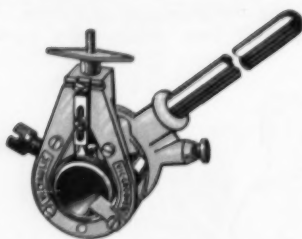
The new, boltless, speed coupling, Style 78. Hinged into one assembly for fast piping hook-up or disassembly. Hand locks for savings in time and money. Ideal for portable lines. Sizes 1" to 8".

## COUPLINGS FOR EVERY PIPING JOB



### VICTAULIC FULL-FLOW FITTINGS

Elbows, Tees, Reducers, Laterals, a complete line—fit all Victaulic Couplings. Easily installed — top efficiency. Sizes  $\frac{3}{4}$ " to 12".



### VIC-GROOVER TOOLS

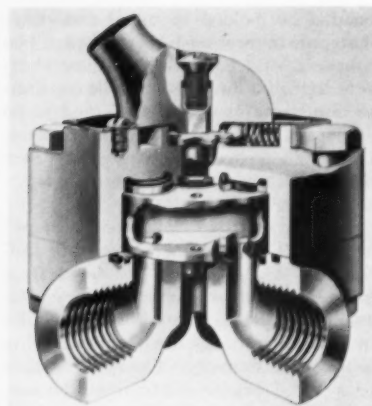
Time saving, on-the-job grooving tools. Light weight, easy to handle — operate manually or from any power drive. Sizes  $\frac{3}{4}$ " to 8".

## PLUS FITTINGS AND GROOVING TOOLS

"EASIEST WAY TO MAKE ENDS MEET"

Promptly available from distributor stocks coast to coast.  
Write for NEW Victaulic Catalog-Manual No. 55-B-9

**VICTAULIC** COMPANY OF AMERICA  
P. O. BOX 509 • Elizabeth, N. J.



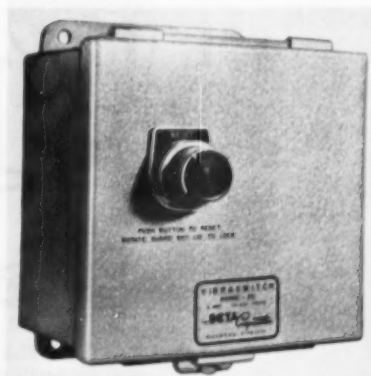
stainless-steel sealing rings backed by "O" rings of synthetic rubber are located on opposite sides of the copper-coated-steel valving disk. The sealing force of these rings against the faces of the disk is proportional to the working pressure, and as the latter increases, the seals become tighter. The handle has stops with ball detents at both extremes for flow in either direction and midway in the off position. All bodies have side ports tapped for 4-way closed center service. For 2- or 3-way use, standard pipe plugs are inserted in the idle ports. The new Seal-Tite valve is available in sizes from  $\frac{1}{8}$  to 1 inch, female pipe.

Circle 16E on reply card

Under the name of Ready Dry, Kimball Chemical Corporation has introduced a primer for painting metals even with the strongest types of vinyls and lacquers. It can be applied by air spray, brush or dipping and is said to dry in minutes. According to the manufacturer, it has withstood the Navy salt-spray test; is resistant to most acids and alkalis; adheres well to clean or rusted, damp or dry, surfaces; and remains non-brittle at temperatures varying from -50° to 350°F.

Circle 17E on reply card

In addition to its Vibraswitch for indoor use, The Beta Corporation is now offering a unit for the protection of fans,

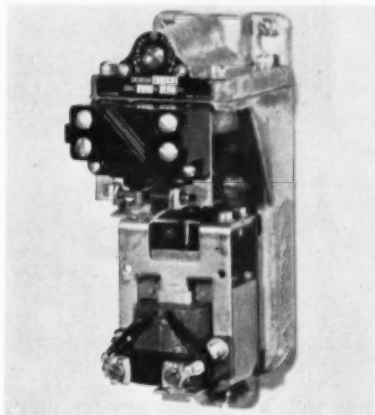




blowers, pumps, motors, air compressors, turbines and other rotating equipment working in dust- and oil-laden atmospheres. It is enclosed in a gasketed box with an external reset and lock and is adjustable over a wide normal vibration range. The instrument is said to detect malfunctions such as failing bearings, unbalance, broken blades and bent shafts from slight increases in vibration, shutting down a machine before costly damage is done. It is also furnished in an explosionproof enclosure for use in hazardous locations.

Circle 18E on reply card

A heavy-duty pneumatic timer for automatic control circuits used in machine-tool sequencing, processing in chemical and other industries, cranes and conveyor lines has been developed by the General Purpose Control Department of General Electric Company. The device



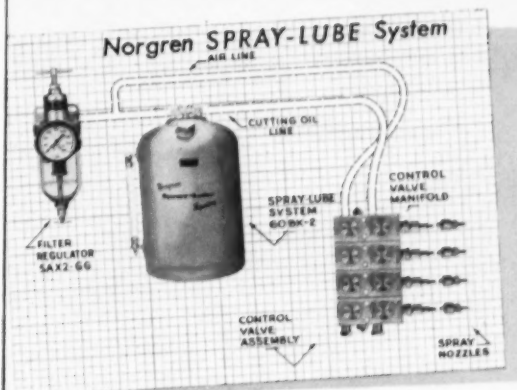
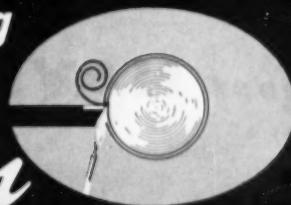
has undergone millions of operations in laboratory tests over a 2-year period and has a time delay of  $1/5$  second to 180 seconds with an accuracy plus or minus of 10 percent of the setting. It is of cast-frame construction to prevent misalignment through shock and vibration,



"Aren't you going to change for dinner?"

**Faster Metal Cutting  
at LOWER COST  
with improved**

**Norgren**  
**SPRAY-LUBE**



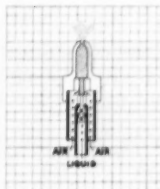
for  
Tapping Machines  
Drill Presses  
Milling Machines  
Grinders  
Lathes  
Boring Machines  
High-Speed Saws  
Stamping Presses  
Die Lubrication  
Other Metal  
Working Equipment

**Better Lubrication**—A better, more uniform spray of cutting oil is applied directly upon the close interface between the tool and work piece. Tool wear is less—saves tool costs, cuts down-time.

**Faster Cooling**—Because of the larger fluid surface area of the spray and the expansion of the compressed air, heat is dissipated quicker. Cutting can be faster—production stepped up.

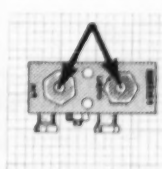
#### Uniform Spray

Air and cutting oil, with flow of each accurately controlled, are conveyed to the nozzle by means of a tube within a tube connection.



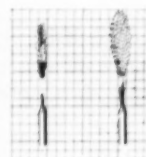
#### Tamper-Proof Controls

Allen-head screws are used on the control valves for adjusting flow of both air and liquid.



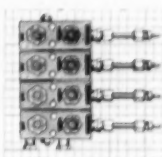
#### Accurate Control of Spray

By adjusting the pressure and the individual outlet controls for air and coolant, spray can be applied in exactly the right quality and quantity for any metal cutting or metal forming job.



#### Valves Compactly Manifolded

For multi-point application of SPRAY-LUBE, the control valves are designed so that they can be closely assembled in a manifold arrangement.



#### Compact, Convenient Size

A space only 14"x20"x7" is required for a 2-gallon unit—4 to 12 fluid ounces of liquid an hour per nozzle are sufficient for most operations.



3407 So. Eliot St., Englewood, Colo

Without obligation, learn how improved Norgren SPRAY-LUBE can reduce costs in your plant. Call your nearby Norgren Representative listed in your telephone directory—or WRITE THE FACTORY FOR BULLETIN 537.

**Pioneer and Leader in Oil-Fog Lubrication Since 1930**

Circle 21A on reply card

# NO SECRET

## About **NAYLOR** Performance



De-watering quarry after Hurricane Diane

The familiar Naylor spiral brings the outstanding performance of this light-weight pipe right out into the open — for water, air, ventilating and materials handling in construction service.

It's no secret that Naylor's exclusive lockseamed, spiralwelded structure means extra strength and safety. The spiral truss acts as a continuous expansion joint to absorb shock loads, stresses and strains. In addition, it provides greater collapse strength for push-pull ventilation and other applications normally requiring heavier-wall pipe.

For all-around service on construction jobs, you can depend on Naylor pipe, in diameters from 4" to 30", to get the economy of light weight without sacrifice of performance.

Write for Bulletin No. 507.

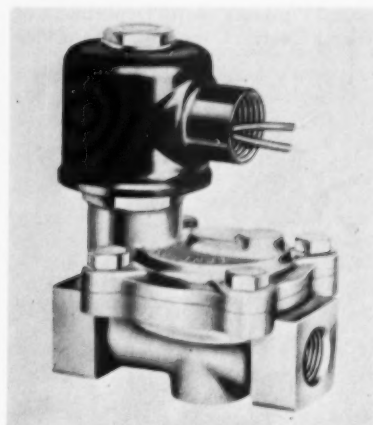
**NAYLOR**  **PIPE**

**Naylor Pipe Company** • 1245 East 92nd Street, Chicago 19, Illinois  
Eastern U.S. and Foreign Sales Office: 350 Madison Avenue, New York 17, New York

and a filtered, vertical air intake in an enclosed space serves to keep out dust that might affect time intervals. All wiring terminals are accessible from the front. Operation of the instrument can be changed from on-delay to off-delay with only a screw driver.

Circle 19E on reply card

A new diaphragm-type solenoid valve suitable for the shutoff control of liquids and gases at operating pressures up to 250 psi has been designed by General Controls Company. The K-181, as it is designated, is normally closed and features a forged brass body, packless construction, bubble-tight shutoff and 2-wire continuous-duty solenoids. Because of its diaphragm action and full-flow ports it is said to handle large vol-



umes with a minimum pressure drop. It is made in two sizes ( $\frac{3}{8}$  and  $\frac{1}{2}$  inch) and models: one for general service with water, light oils and gases and the other for water at temperatures up to 200°F. A waterproof coil, explosion-proof housing and manual opening device are optional.

Circle 20E on reply card

Clay pipe joints that can be snapped together, screwed or pressure sealed are being produced by The Robinson Clay Products Company. The first consists of rings with curved flanges that are bonded at the factory to the bell and around the spigot of the firm's Wedge-Lock pipe. The rings are of Plastisol, a polyvinyl-chloride plastic, and form a tight mass when fused together. In the case of Screw-Seal pipe, the spigot end is fitted with a threaded Plastisol casting and the joint is effected by a female threaded phenolic collar. The pressure-sealed type is an inflatable gasket that slips over the spigot and fits inside the bell. It is for large-diameter pipe and is filled with thin grout that is introduced under 50 psi pressure through a small valve. All three are said to be watertight and easy to install.

Circle 21E on reply card

## BRIEFS

The demand for inflatable plastic balloons, used mostly for high-altitude meteorological research, has increased so much that General Mills, Inc., has formed a department with around 60 employees for producing them.

Canada's mineral production in 1955 was at an all-time high of \$1,778,400,000—a gain of 19.5 percent over the 1954 total. Petroleum was in first place, followed by copper, nickel and gold, in that order. Ontario led the provinces with an output valued at \$578 million.

According to the American Petroleum Institute, the world's proved oil reserves have nearly tripled in the last ten years, with the Middle East possessing by far the greatest percentage. The total is estimated at 190 billion barrels of which the United States has slightly under 35.5 billion barrels.

Water is about the cheapest thing we buy, according to John H. Murdoch, Jr., chief counsel for American Water Works Company, of Philadelphia, Pa. "Water is cheaper than dirt—that is, 5 to 10 cents per ton," he said recently, adding that an average householder's water bill for a year can be paid with the proceeds of one day's labor.

While the farmer's income was dropping one-third between 1948 and 1956 the market value of all U.S. farmland was, paradoxically, rising by 38 percent: from \$74 billion to \$102 billion, and the upward trend is continuing. One explanation offered is that far-sighted buyers visualize even higher prices in the future as it becomes necessary to raise food for a much bigger population.

Emulating the collegiate custom of awarding letters for athletic attainments, Colorado Fuel & Iron Corporation gives monogrammed jackets to mill employees who compile outstanding production records. Eight first and second



# SPEED UP THESE TOUGH JOBS



Ingersoll-Rand GR-125 Gyro-Flo Compressor, Continental-powered, operating Mall chain saw cutting 12" x 12" timber to repair pier. Equipment in use on an eastern railroad.

## WITH CONTINENTAL RED SEAL POWER

Year after year, ever since 1902, Continental engines have been proving their dependability in a steadily-lengthening list of special-purpose machines. Today, no matter what the exact requirement of the job, there's a Red Seal model—gasoline, Diesel, or LPG—engineered and built to meet it down to the last detail—a model with the proper performance characteristics, profile, shape and weight. In the industrial line there are models at closely-spaced levels—from 14 to 240 horsepower. You find them on an almost endless number of operations, speeding the tough jobs and delivering their full work quota, day in and day out, with a minimum of time out for adjustment or repairs.

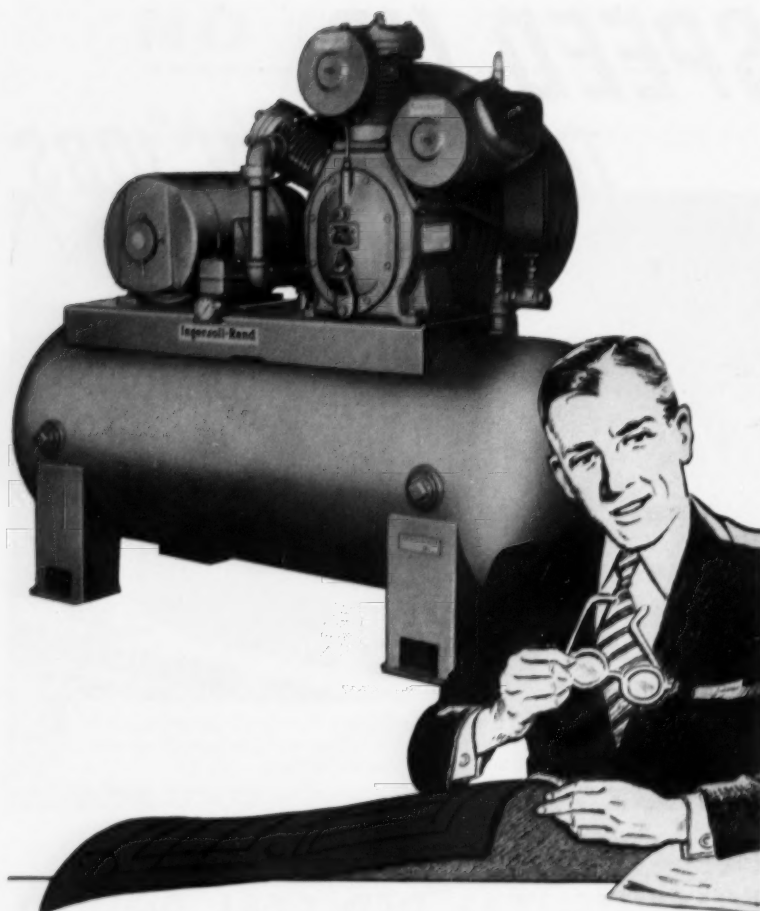
SERVICE FACILITIES AND GENUINE RED SEAL PARTS  
AVAILABLE EVERYWHERE



**Continental Motors Corporation**

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Our daily plant production is  
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We can't afford a shut-down. We  
must have the most dependable  
air compressor that we can buy."

**Ingersoll-Rand**

3-461 11 Broadway, New York 4, N. Y.

**PACKAGED AIR-COOLED COMPRESSORS, 1/2 through 20 hp**

Circle 24A on reply card

helpers on two of the open-hearth furnaces at Pueblo, Colo., were recently rewarded in this manner for turning out more than 10,000 tons of steel in a month from each unit.

The Elwell-Parker Electric Company, of Cleveland, Ohio, is observing the fiftieth anniversary of the production of industrial trucks. The 1906 forerunner of today's diversified materials-handling vehicles was an electrified baggage truck built for the Pennsylvania Railroad.

**Books and Industrial  
Literature**

The 1956 *National Directory of Safety Films* lists more than 1200 moving pictures on industrial, commercial, transport, traffic, home and farm safety, first aid and fire prevention as well as on civil defense. It contains such information as millimeter, running time and a summary of the plot of each film, which may be purchased, rented, loaned or obtained on a long-term lease. Published by the National Safety Council, 425 N. Michigan Avenue, Chicago 11, Ill. Price, \$1.00.

Every type of standard and special set screw made by Set Screw & Mfg. Company is described in Catalogue No. 21 that has just been released. Among the latter are the new Hopper-Fed screws, and automatic feed mechanisms also are discussed and illustrated.

Circle 22E on reply card

A booklet offered by Minnesota Mining & Manufacturing Company gives case histories of abrasive operations including pre-finishing, weld grinding and blending, removing imperfections, and finishing and polishing with 3M Type belts, sheets, disks and wheels.

Circle 23E on reply card

Series D-100 standard floating-shaft and mill-motor type dihedral couplings designed to take care of angular and offset misalignment up to 12° and manufactured by Ajax Flexible Coupling Co., Inc., are illustrated and described in Catalogue 62.

Circle 24E on reply card

Facts and figures on automatic, semiautomatic and regular quick-detachable couplers for air, oil and grease lines are contained in a catalogue offered by Foster Manufacturing Company, Inc. Illustrations show practical applications of the fittings with air-operated tools.

Circle 25E on reply card

A revised *Carmet Catalogue* released by Allegheny Ludlum Steel Corporation gives detailed information and charts on carbide applications and available tools with carbide tips. Of 32 pages, it contains a section on the selection of carbide grades that users should find helpful.

Circle 26E on reply card

Tips on how to plan installations and order shelving in more than 1000 combinations to fit any storage or supply-handling need are contained in a 27-page catalogue published by the Hollowell Division of Standard Pressed Steel Company, Jenkintown, Pa. Step-by-step drawings show how to build anything from simple post-and-shelf arrangements to units with backs,



sides, tops and sliding or swinging doors. Copy of the publication can be obtained from Hallowell distributors or by written request on company letterhead.

Product features, dimensions and applications of General Electric Company's Neutralene gas producers which generate purified exothermic gas for protective atmosphere heat treating are contained in Bulletin GEC-1375 available upon request.

Circle 27E on reply card

*The Inside Story* is the title of a booklet issued by Caterpillar Tractor Co. that is based on the point that track rollers look alike but differ greatly in internal design. It deals specifically with rollers for D9, D8 and D7 tractors.

Circle 28E on reply card

Complete information about installation accessories for air, hydraulic, steam, liquid and lubrication applications is given in a 16-page catalogue, No. 17-E, released by J.N. Fauver Company, Inc. A table on how to determine pipe threads is included.

Circle 29E on reply card

In Bulletin 132, Niagara Blower Company illustrates and explains the functions of its new sectional Aero Heat Exchanger for cooling liquids in industrial plants without recourse to large supplies of water and with added savings in operating costs.

Circle 30E on reply card

Data on the corrosion resistance of titanium are contained in an 8-page bulletin announced by Mallory-Sharon Titanium Corporation. In addition to indicating corrosion ratings for the metal when exposed to many common types of corrosive agents, its uses based on this resistance are described.

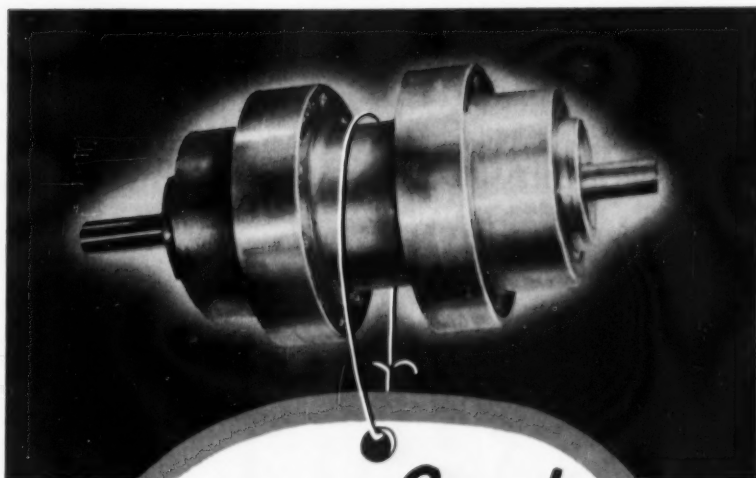
Circle 31E on reply card

Engineering data, flow charts, operation and construction details, etc., on the latest ASCO 2-, 3- and 4-way solenoid valves are contained in a 32-page condensed catalogue, No. 201, that readers can obtain by writing to the Automatic Switch Company, 391 Lakeside Avenue, Orange, N.J.

What is said to be one of the most comprehensive reference works ever compiled on aluminum has been made available to industry by Aluminum Company of America, 781 Alcoa Building, Pittsburgh 19, Pa. Of 176 pages, it contains 140 tables that tell the story of Alcoa alloys and mill prod-



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# For High Speeds ...this new dynamically balanced Waldron COUPLING

An entirely new design . . . built of specially selected material . . . thoroughly tested for proper balance. Truly a precision made coupling in every respect, accurately machined to close tolerances. If yours is a high speed application, write for our descriptive Bulletin No. 52.

JOHN WALDRON CORP. • NEW BRUNSWICK, N. J.

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TYPES

**Waldron**  
COUPLINGS

SPECIAL  
TYPES

Circle 25A on reply card



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GAS, OIL & CHEMICAL COMPANIES  
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## PACKINGS & PISTON RINGS

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Circle 26A on reply card

ucts with little text. One section explains the code-numbering system used to designate alloys and their modifications. Copies of *Alcoa Aluminum Handbook* may be obtained by request on company letterheads.

A 72-page illustrated catalogue released by Airmatic Valve, Inc., covers its entire line of air-control valves for low- and high-pressure installations and also gives facts about its single- and double-acting air and hydraulic cylinders and strainers for pipeline protection.

Circle 32E on reply card

By means of a colored chart that shows the complete chemical, mechanical and work characteristics of a wide range of sintered bearing materials it is possible to select the one best suited for a given job. It can be obtained only by request on company stationery from Bound Brook Oil-Less Bearing Company, Bound Brook, N.J.

In an attractive booklet entitled the *New England Life Electro-Matic Story* the American Air Filter Company, Inc., tells how an office building solved a serious maintenance problem by substituting self-cleaning electronic precipitators for the mechanical air filters that were installed when the air-conditioned structure was put up in 1940.

Circle 33E on reply card

The purpose of a new booklet released by Sylvania Electric Products Inc. is to point out to plant managers or engineers how they can improve industrial seeing and working conditions by the use of mercury-vapor lamps. Well illustrated, the 11-page publication includes technical data, gives installation hints, and discusses high-bay reflectors, color requirements and operating characteristics.

Circle 34E on reply card

Condensed Catalogue 11B illustrates and describes The Nylok Corporation's complete line of one-piece self-locking fasteners. The locking medium is a resilient nylon plug inserted permanently in the body of the bolt, screw or nut and projects slightly beyond the crest of the thread. When the mating parts are engaged the nylon is compressed, making what is claimed to be a leakproof joint.

Circle 35E on reply card

The 1956 edition of the price list and index of *American Standards* is now available without charge from the American Standards Association, 70 East 45th Street, New York 17, N. Y. The 56-page book covers 1600 standards and gives a resume of ASA special publications, many of which are free, and the addresses of sales agents for American standards in other countries.



"Young lady, we never lose valuable papers around here—have ya checked the waste paper basket?"



## HEAVY DUTY PRESSURE SWITCH FOR AIR COMPRESSORS

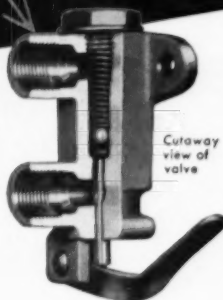
Class 9013  
Type ASG  
Form X

### COMPLETE RANGE IN 1 CONTROL UNIT

Either 20 to 180 or 25 to 250 PSI.  
No spring changes required.

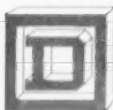
### MORE AIR CAPACITY

with improved 2-way ball  
and "O" ring type valve.



Cutaway  
view of  
valve

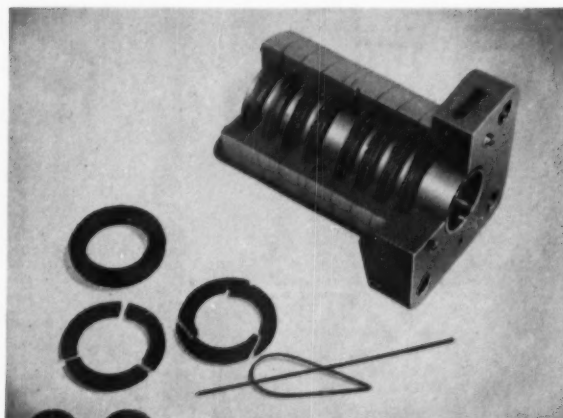
Write for Bulletin 9013A. Address Square D Company,  
4041 N. Richards Street, Milwaukee 12, Wisconsin



NOW... E&C PRODUCTS ARE A PART OF THE SQUARE D LINE!

**SQUARE D COMPANY**

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## Look to **COOK** for Better CARBON PACKING RINGS!

Cook carbon packing rings are made of a special carbon graphite material that automatically assures you high resistance to wear, chemical inertness and excellent heat conductivity.

If you have sealing requirements for non-lubricated compressors, write today for a sample carbon ring, plus

literature on Cook's complete line of packing materials. Address C. Lee Cook Company, 930 South Eighth Street, Louisville 3, Ky.

**C. LEE  
COOK  
COMPANY**

Sealing Pressures Since 1888

Circle 28A on reply card

SEPTEMBER, 1956

**NOW..**  
GREATER THAN EVER  
PROTECTION  
TO YOUR AIR LINE  
*with the outstanding*

# M·B

## WHIRL-A-WAY FILTER, REGULATOR AND LUBRICATOR ASSEMBLY and AUTOMATIC AIR TRAP

MODEL W-4



### AIR TRAP EJECTS WATER AUTOMATICALLY AND RAPIDLY

The **FILTER** removes solids .00039 and larger. Transparent bowl provides visibility. The **REGULATOR** can pass large volume with an unrestricted flow and minimum pressure drop. Self-bleeding, compact. Machined from bar aluminum.

The **LUBRICATOR** delivers desired volume of oil. Bowl can be refilled without shutting off air supply.

The **AIR TRAP** is an Automatic Water Ejector for all air line applications. Assures dry air in pneumatic systems at all times. Eliminates costly downtime and assures preventive maintenance. **WRITE FOR LITERATURE.**

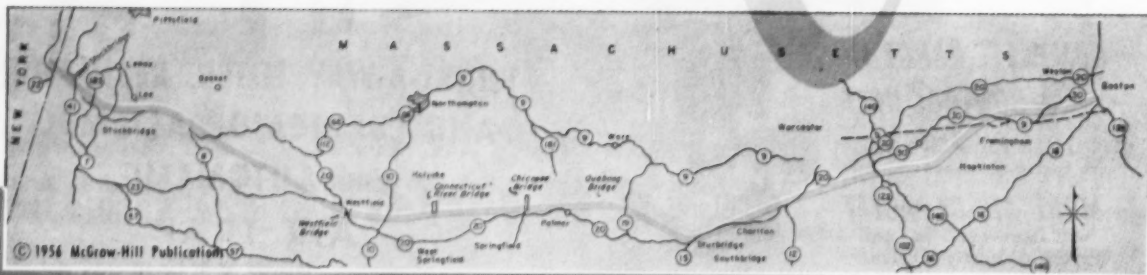
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DETROIT 3, MICHIGAN

Circle 29A on reply card

ADV. 28

Delivering more than 53,000 cfm of air power

# 87 GYRO-FLO



Typical view of GYRO-FLO portable compressors at work on the Massachusetts Turnpike. Here, three 600 cfm units, operated near North Grafton, Mass., by the Gilbane Building Company, are supplying air power to five Ingersoll-Rand FM-3 Wagon Drills.

**CONTRACTORS' COMBINATION**

COMPRESSORS  
ROCK DRILLS  
AIR TOOLS  
CARSET BITS  
PUMPS



on the Massachusetts Turnpike

# PORTABLE COMPRESSORS

*help speed construction of  
this 123-mile cross-state expressway*



**S**TRETCHING from Boston on the east to a proposed connection with the New York State Thruway on the west, the Massachusetts Turnpike project is moving rapidly ahead to completion.

It's a big job—with the accent on speed. And 87 GYRO-FLO Portable Rotary Compressors—including 77 units each of 600 cfm capacity—are delivering a mighty large share of the air power required for the huge drilling and blasting work involved. Putting down the blast holes are a number of I-R Drillmaster and Quarrymaster superdrill rigs and many wagon drills, Jackhamers and other I-R rock drills.

In severe heavy-duty service such as this, the maintenance-free features of the GYRO-FLO portable cannot be over-emphasized. There are no pistons, rings, rods, or valves to wear out, adjust, or replace. This assures both simpler operation and greater dependability in performance. The GYRO-FLO provides cool, oil-free air, smoothly, without pulsation, at pressures that are automatically maintained between 100 and 110 psi under all load conditions.

Now available in 85, 125, 210, 315, 600 and 900 cfm sizes, GYRO-FLO compressors offer a new high in portable air-power efficiency. See your I-R distributor or branch office for full information on the compressor size that will meet your needs best.

## Ingersoll-Rand

2 452

11 Broadway, New York 4, N.Y.

AN UNBEATABLE COMBINATION . . . GYRO-FLO COMPRESSORS AND I-R ROCK DRILLS



YOU TOO can maintain Air Tools and other air using equipment in effective operating condition by using the TOOL-OM-ETER to show excessive air consumption, indicating the necessity for adjustment or repairs.

For further information write for Bulletin A-8.

## NEW JERSEY METER CO.

*"Specialists in Compressed Air Devices"*

PLAINFIELD, NEW JERSEY

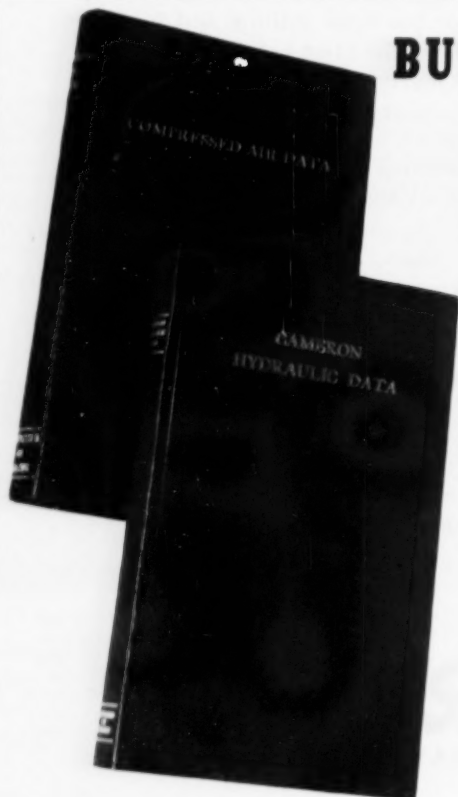


NORTH AMERICAN AVIATION, INC.

Photograph shows Inspector D. L. Underwood, of North American using a 1" TOOL-OM-ETER to check Air Tool for proper air flow.

YOU TOO CAN "Keep your Air pressure UP and your Air cost DOWN".

Circle 31A on reply card



## BUY BOTH BOOKS FOR \$5.00

**COMPRESSED AIR DATA** (Fifth Edition): 346 pages on the theory and practice of compressed-air engineering. 12 chapters devoted to terminology and definitions; theoretical compression of air; boosters and vacuum pumps; turbo or centrifugal blowers and compressors; tables and data; intake air; after-cooling, intercooling, reheating; cost of compressing air; pumping with air; gas compression; installation of compressors; belting; application and performance; and measurement of air flow. Many illustration and formulae.

**CAMERON HYDRAULIC DATA** (Twelfth Edition): 240 pages on hydraulics, water data, miscellaneous liquids, steam data, electric data, and miscellaneous data. Hundreds of tables, curves, and formulae. The tables showing friction losses in pipe are believed to be the most complete ever offered in one book. An entirely new set of friction tables based on the Fanning formula is included for liquids of various viscosities in standard steel pipes ranging from 1" to 20". The book is almost a "must" for engineers dealing with such steam and liquid-handling equipment as pumps, pipe systems, steam condensers, steam turbines, steam-jet ejectors, heat-transfer equipment, and water vapor refrigeration units.

Fill out the coupon and mail it today.

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Please send me:

- ☐ Compressed Air Data and Cameron Hydraulic Data ..... Both books for \$5.00  
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☐ Enclosed is (money order) (check) for \$ ..... ☐ Send books C.O.D. I understand that the books will be sent me postpaid, and that they may be returned within 10 days if not satisfactory.

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Company .....

Street No. ....

City ..... State ..... Country .....

**NO MOISTURE  
OR DIRT  
GETS BY HERE**

**Johnson  
Self-Draining  
Compressed Air  
Separator.....**

Like all Johnson Separators the new Type "SA" Self-Draining Separator combines the two most effective principles of removing moisture and dirt from compressed air:

1. Controlled expansion of air in separator precipitates most of the moisture.
2. A "thousand baffles" of coarse mesh repeatedly changes flow of direction to capture remaining foreign matter.

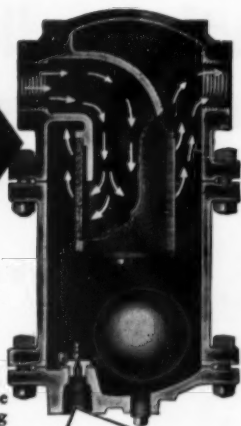
Self-Draining—a simple but complete trap mechanism built right in, automatically drains separator whenever necessary.

WRITE FOR CATALOG

**The Johnson Corporation**

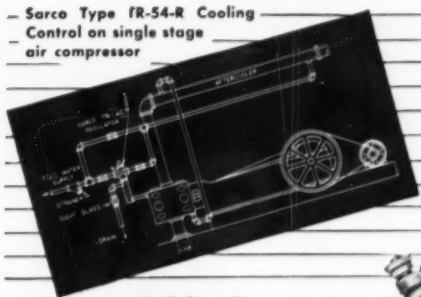
830 WOOD STREET THREE RIVERS, MICH.

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Johnson Separation  
Devices include  
Separators for  
Compressed Air or  
Steam. After cool-  
ers, oil absorbers.

Sarco Type FR-54-R Cooling  
Control on single stage  
air compressor



**efficient  
COMPRESSOR  
COOLING**

- Do you want to avoid over — or under — cooling?
- Do you want to save cooling water and lubricants?
- Do you want to increase the efficiency and life of your air compressor? ... then install SARCO COOLING CONTROLS

Simple • Self-operated • Inexpensive  
Ask for Bulletin No. 701

**SARCO COMPANY, INC.**

EMPIRE STATE BUILDING, NEW YORK 1, N. Y.  
Represented in Principal Cities  
SARCO CANADA LTD., TORONTO 8, ONTARIO

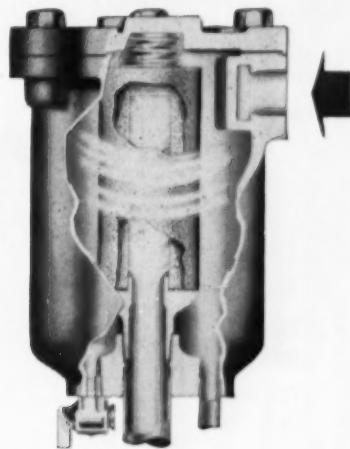


Sarco  
TR-54-R

518

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# Get Clean Air for Your Tools



## Adams Poro-Stone Air Filters **SAVE MONEY • TIME**

You get protection that counts with Adams Poro-Stone Air Filters. Damaging water, rust contaminated oil, dust and pipe scale are removed from your compressed air ... and there's virtually no pressure drop across the Adams filter.

Separation of foreign matter is in two stages — by centrifugal action from the movement of the air itself ... by diffusion through the permanent Poro-Stone filter tube.

Not only do you save money in longer tool life and trouble-free operation, but also you save time. That's because Adams filters are quick to clean ... have no moving parts to wear ... need no special tools ... proper assembly is all but fool-proof.

For full details and prices, write today for your copy of New Bulletin 117.

**R. P. ADAMS CO., INC.**

209 E. PARK DRIVE

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R. P. ADAMS COMPANY, INC.

JY-56

209 EAST PARK DRIVE  
BUFFALO 17, NEW YORK

Please rush me your New Bulletin 117 with sizes and prices.

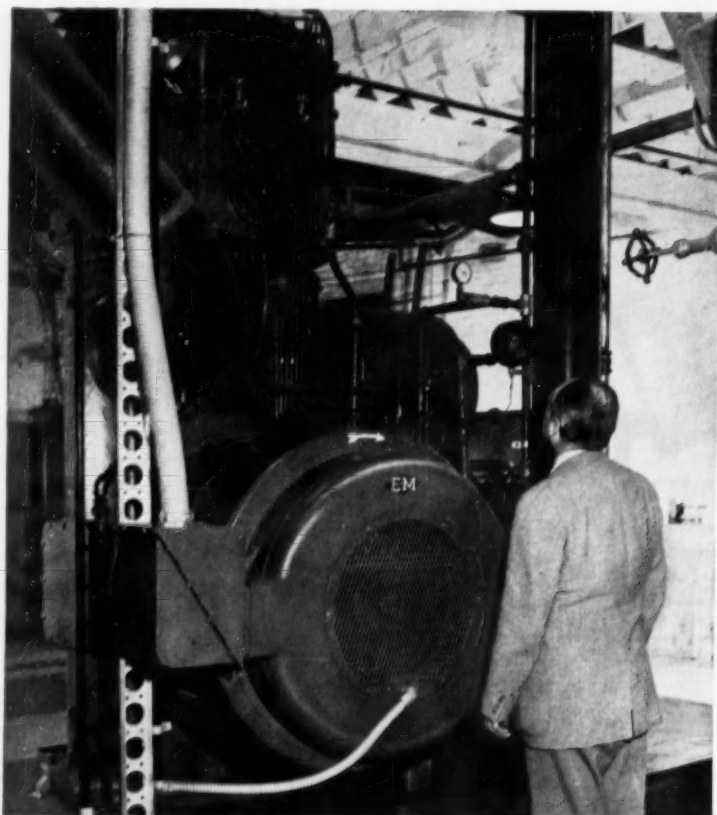
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Circle 34A on reply card

# What control would you specify for a flange-mounted synchronous motor air compressor drive?



Paktrol efficiently controls this E-M 200 hp, 514 rpm, 1.0 PF, 440-volt Flange-Mounted Synchronous Motor at The Eberhard Company.

## Here's why Eberhard chose the NEW **E-M** **PAKTROL CONTROL**

The Eberhard Company of Cleveland, Ohio, a division of Eastern Malleable Iron Company, selected an E-M Flange-Mounted Unity Power Factor Synchronous Motor to drive an air compressor in their plant. The compressor is unloaded at start and operates at standard load and speed.

Such characteristics meant that a simplified control could be used. A control having meters, field rheostat and a separate motor-generator set for field excitation was unnecessary.

Careful comparison by Eberhard of the new simplified E-M Paktrol Control with other type controls resulted in it being chosen for the features given below.

### Features and Advantages of NEW PAKTROL CONTROL

**1 Lower Cost** — Wherever Paktrol can be used costs are saved two ways. Its built-in selenium rectifier lowers both initial and installation costs as compared to those of a separate synchronous motor control and motor-generator set.

**2 Simple Operation** — Start-stop pushbutton magnetic full-voltage operation with "conscious" control by the E-M developed Polarized Field Frequency Relay system.

**3 Full Protection for Motor and Control** — Relays protect against overloads, overcurrents, abnormally low line voltage, single-phase operation, or out-of-step operation. Fuses protect rectifier and transformer.

**4 Minimum Maintenance** — Static rectifier for d-c field excitation eliminates maintenance of brushes, commutator, and bearings of conventional rotating exciter.

Paktrol is available for use with unity power factor flange-mounted synchronous motors driving air compressors in ratings of approximately 75 thru 200 hp in applicable speeds of 720, 600, or 514 rpm.

Let your nearest E-M sales engineer show you how to get the best performance from your air compressor flange-mounted synchronous motor drive. Write the factory for E-M Paktrol Control Bulletin No. 220.



3100-TPA-2184

**ELECTRIC MACHINERY MFG. COMPANY**  
MINNEAPOLIS 13, MINNESOTA



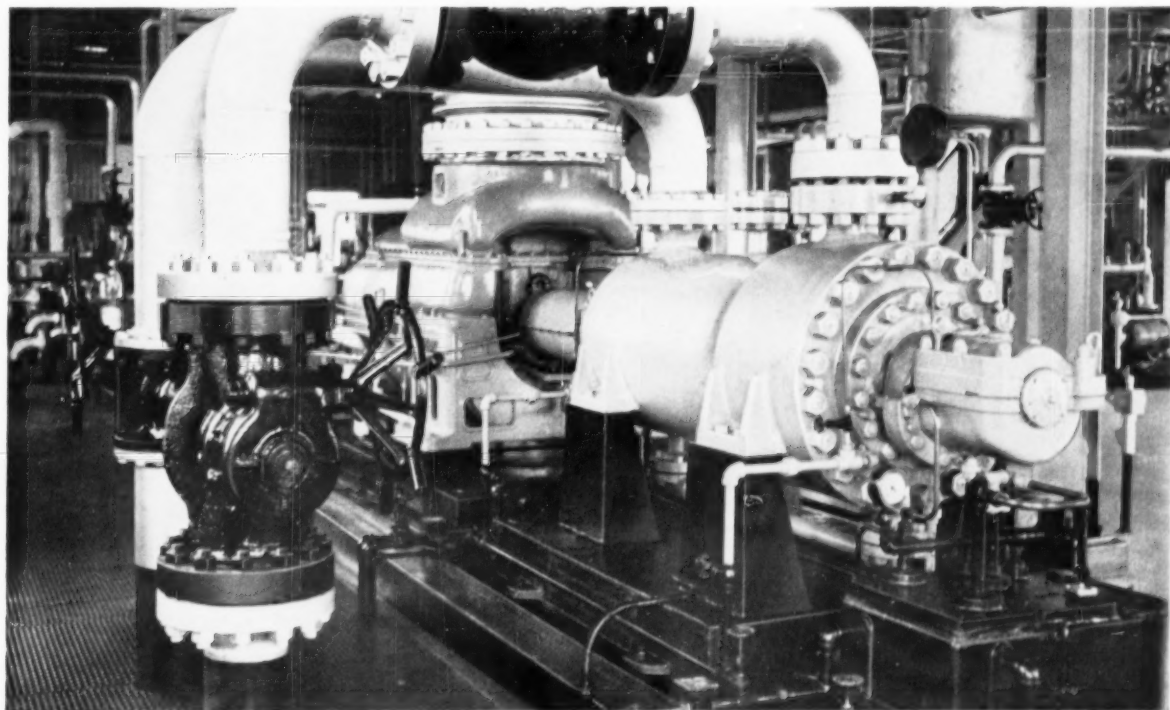
**Specialists in making motors do EXACTLY WHAT YOU WANT THEM TO**



# Ingersoll-Rand High-Pressure Pumps at the Katy Cycling Plant

## SET IMPRESSIVE RECORD

### of Maintenance-Free Operation



1943  
1944  
1945  
1946  
1947  
1948  
1949  
1950  
1951  
1952  
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1954  
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1956

**13**

years without opening!

Two nine-stage CHT pumps were put into service at the Katy Cycling Plant in July 1943. These five-inch, double-case units, one of which is shown above, take lean oil at about 90°F. and 70 psi from the still after coolers and discharge it to the absorbers at 1850 psi. Throughout this entire thirteen year period, the pump casings have not been opened. The original bearing linings are still in service and the only maintenance required has been the renewal of inboard shaft sleeves and infrequent repacking. A third I-R pump of the same design, installed in 1944, has required no repairs to date.

This outstanding performance record is a typical example of the *extra dependability* that's built into every Ingersoll-Rand pump. Each unit is designed for real, long range economy that pays off in lower operating and maintenance costs year after year. If you have a pumping problem, your nearest I-R representative will be glad to help you.



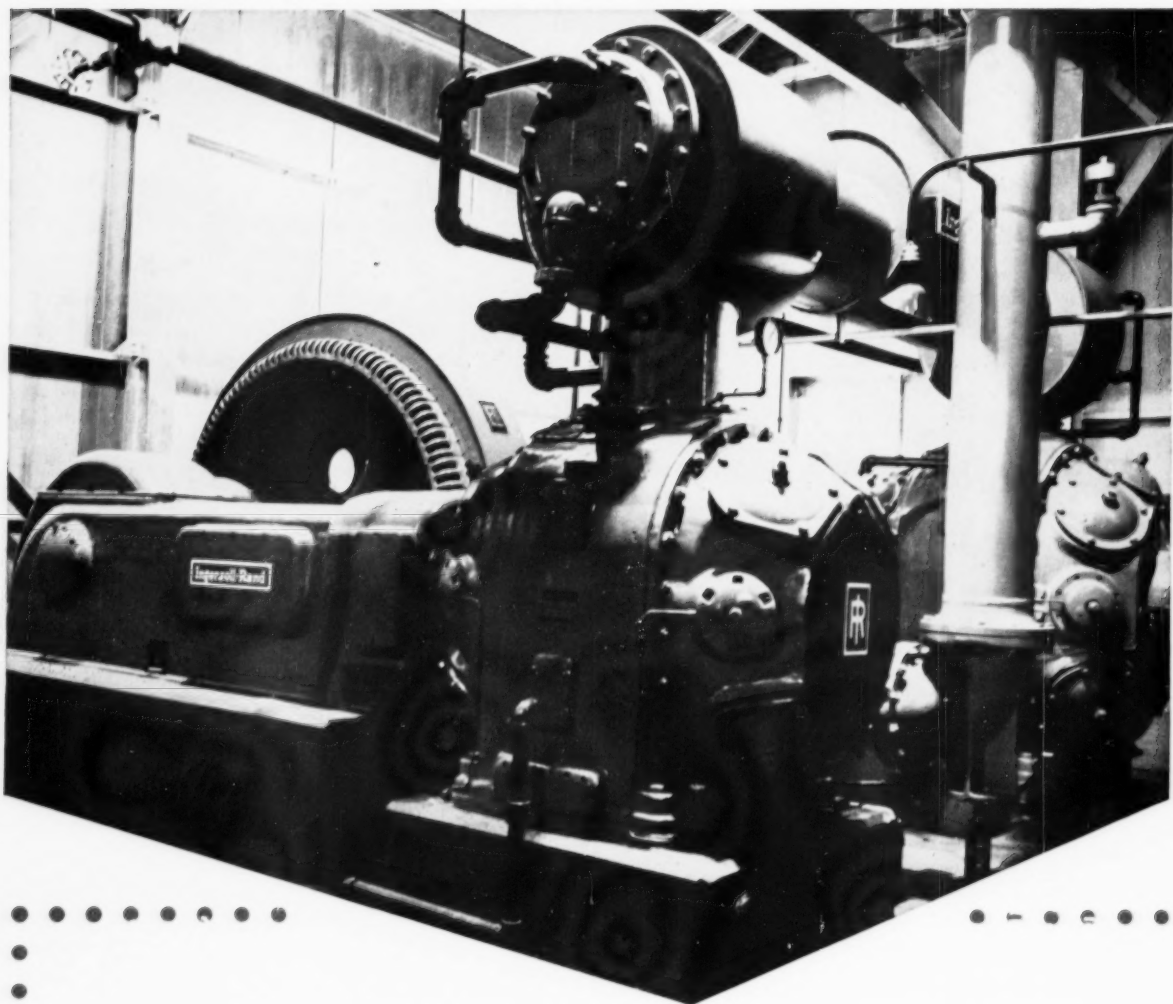
## Ingersoll-Rand

11 Broadway, New York 4, N. Y.

10-438

COMPRESSORS • DIESEL & GAS ENGINES • PUMPS • AIR & ELECTRIC TOOLS • CONDENSERS • VACUUM EQUIPMENT • ROCK DRILLS

Circle 36A on reply card



## GET FREEDOM from deposits and rust

**CLEAN** operation, freedom from deposits and rust — you can count on those benefits when you lubricate your air compressors with *Texaco Regal Oil R&O*. And you'll enjoy full operating efficiency and consistently low maintenance costs.

*Texaco Regal Oil R&O* is a very special oil, ideal for air compressor lubrication. It is made from choice stocks, carefully refined and fortified with special rust and oxidation inhibitors. It has exceptional ability to lubricate effectively and to prevent harmful deposits.

There is a complete line of *Texaco Regal Oils R&O*. You can get one exactly right for any compressor . . . whatever its size, type, or pressures involved, whatever the operating conditions.

A Texaco Lubrication Engineer will gladly help you select the proper ones. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the United States, or write:

☆ ☆ ☆

The Texas Company, 135 East 42nd Street,  
New York 17, N. Y.



**TEXACO Regal Oils R & O**  
FOR ALL AIR COMPRESSORS AND OPERATING CONDITIONS